

390



# California Regional Water Quality Control Board

## Los Angeles Region



Recipient of the 2001 Environmental Leadership Award from Keep California Beautiful

Alan C. Lloyd, Ph.D.  
Agency Secretary

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Arnold Schwarzenegger  
Governor

March 8, 2005

Mr. Brian Mossman  
Boeing Realty Corporation  
4900 East Conant Street, Building 1  
Long Beach, CA 90809

**CALIFORNIA WATER CODE SECTION 13267 ORDER TO INVESTIGATE GROUNDWATER POLLUTION – BOEING REALTY CORPORATION, FORMER C-6 FACILITY, 19503 SOUTH NORMANDIE AVENUE, TORRANCE (FILE NO. 95-036, SLIC NO. 0410)**

Dear Mr. Mossman:

The California Regional Water Quality Control Board, Los Angeles Region (Regional Board) is the primary state agency charged with the protection of the State's water resources. Regional Board staff are working with the United States Environmental Protection Agency (EPA) to investigate the sources, characteristics and migration of groundwater contamination from multiple facilities at and in the vicinity of the Montrose-Del Amo "Joint Site" Superfund project area as defined by the EPA-approved Record of Decision (ROD) for Dual Site Groundwater Operable Unit Del Amo and Montrose Chemical Superfund Sites.

Regional Board staff and EPA have been working closely to ensure that all facilities that have contributed to groundwater contamination in the study area are identified, that the full extent of groundwater contamination is determined and that an effective remedial and monitoring program is developed and implemented to stop the spread of contamination and begin restoration of the State's groundwater resources.

Based upon the information provided by Boeing Realty Corporation (BRC), the previous chemical use, storage and/or disposal practices at the former facility located at 19503 South Normandie Avenue (Facility) have contaminated the underlying groundwater with volatile organic compounds (VOCs) trichloroethene (TCE) at 14,000 micrograms per liter ( $\mu\text{g/l}$ ), 1,1-dichloroethene (1,1-DCE) at 2,300  $\mu\text{g/l}$ , tetrachloroethene (PCE) at 620  $\mu\text{g/l}$ , and trans-1,2-dichloroethene (t-1,2-DCE) at 560  $\mu\text{g/l}$ , which exceeds their respective California Department of Health Services Maximum Contaminant Level (MCL). This VOC pollution has degraded the beneficial uses of the State's groundwater resources.

BRC has already installed a shallow well, MWC021, which is near EPA proposed shallow well, MBFC2. MWC021 has detected TCE at 8.9  $\mu\text{g/l}$  in December 2004. Under an approved workplan, BRC will install another shallow well, MWC009, which is near EPA proposed well, MBFC1, after Wal-Mart Stores, Inc. (Wal-Mart) completes its construction in April 2005.

To determine if VOCs have migrated downward into the Gage Aquifer near the property boundary of the Facility, BRC is required to:

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BOE-C6-0066889

March 8, 2005

1. Install two wells, Gage 1 and Gage 2, as described in the attached letter from the EPA dated January 27, 2005 (Letter), including attachments 1 and 2. The location of these wells should be in the general location as presented in the figures attached to the Letter, but moved to the west to be located on the Facility property at the eastern property line.
2. Collect groundwater quality samples for each of the two wells, as specified in the attached Letter.
3. Perform full data validation of laboratory quality control and quality assurance procedures for all samples, as specified in the attached Letter.
4. In order to meet their schedule, EPA is requesting that the laboratory results, water levels, well construction details, wellhead elevations, geophysical logs, and hydrologic control data from the monitoring wells be submitted by May 31, 2005. Therefore, prepare and present three draft copies of a report presenting the preliminary results, if any, of this additional groundwater quality investigation to the Regional Board by **May 31, 2005**. We understand that well MWC009 will be installed after the property owner, Wal-Mart completes its construction in April 2005, and that additional delays may occur if the property owner is not able to complete its on-site construction activities by May 2005. Therefore, BRC is required to submit three final copies of the report presenting the results of this additional groundwater quality investigation to the Regional Board by **July 29, 2005**.

Regional Board staff and/or EPA staff may conduct field oversight and split sampling, therefore, BRC is required to notify Regional Board staff at least 5 business days prior to implementing field work and for any schedule changes. We will review this information and determine if BRC is required to, install additional wells, investigate additional areas or include additional analyses to evaluate the extent of groundwater pollution beneath or downgradient of the Facility.

Pursuant to Section 13267 of the California Water Code, BRC is hereby required to submit, under penalty of perjury, the information requested above by the **May 31, 2005** and **July 29, 2005** due dates. Pursuant to Section 13268 of the California Water Code, failure to submit the required reports or documents by the due dates may result in civil liability administratively imposed by the Regional Board in an amount up to one thousand dollars (\$1,000) for each day the report or document is not received.

**Please call Mr. John Geroch at (213) 576-6737, or Dr. Rebecca Chou at (213) 576-6733 if you have any questions.**

Sincerely,

  
Jonathan Bishop  
Executive Officer

Enclosure: EPA letter dated January 27, 2005.

**California Environmental Protection Agency**



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BOE-C6-0066890

Mr. Brian Mossman  
Boeing Realty Corporation

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March 8, 2005

cc: Michael Lauffer, Office of Chief Counsel, State Water Resources Control Board  
Robert Sams, Office of Chief Counsel, State Water Resources Control Board  
Jeffrey Dhont, United States Environmental Protection Agency, Region IX  
Susan Keydel, United States Environmental Protection Agency, Region IX  
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Mark Stewart, Watermaster, Central Basin, California Department of Water Resources  
Natashia Raykhman, CH2Mhill  
Scott Zachary, Haley & Aldrich

***California Environmental Protection Agency***



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**BOE-C6-0066891**





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION IX  
75 Hawthorne Street  
San Francisco, CA 94105

January 27, 2005

Mr. John Geroch  
Regional Water Quality Control Board, Los Angeles Region  
320 W. 4<sup>th</sup> Street  
Los Angeles, CA 90013

RE: Boeing (McDonnell Douglas Plant) Property and the Dual Site Groundwater Operable Unit; Montrose Chemical and Del Amo Superfund Sites, Los Angeles County, CA

Dear Mr. Geroch:

We want to thank you and Executive Officer Jon Bishop for meeting with us in your office on January 11, where we discussed coordination between EPA and the Regional Water Quality Control Board - Los Angeles (RWQCB-LA) with respect to the former McDonnell Douglas plant and the Montrose Chemical and Del Amo Superfund Sites. As requested by RWQCB-LA, this letter identifies information EPA needs from Boeing (which is the successor to McDonnell Douglas). We appreciate your coordination with us in trying to meet these needs. In order to allow our remedial design process to proceed without further delay, EPA will need to receive the sampling results of the monitoring wells it has requested no later than May 31, 2005.

As we discussed, RWQCB-LA staff have been working on investigations and source control actions for the former McDonnell Douglas plant now owned by Boeing ("Boeing property"), while EPA has been engaged in a remedial design for a groundwater cleanup system for both the Montrose and Del Amo NPL sites. EPA's actions are pursuant to a groundwater remedial action selected by EPA in a 1999 Record of Decision (ROD). Recent data indicates that dissolved phase chlorinated solvent contamination (primarily trichloroethylene (TCE) and related contaminants) from the Boeing property have commingled with the groundwater contamination from the Montrose and Del Amo sites and entered the area of groundwater subject to remedial actions under EPA's ROD. This migrated solvent contamination is present primarily in aquifers that lie deeper than Boeing's present on-property source control efforts proceeding under RWQCB-LA jurisdiction.

We appreciate RWQCB-LA's understanding of the strong relation between the groundwater contamination that has left the Boeing contaminant source areas in multiple aquifers and EPA's ability to effectively implement the ROD. We also look forward to continued coordination with RWQCB-LA on these sites.

At the meeting, we discussed EPA's long-standing request that Boeing voluntarily install and sample monitoring wells that will allow for a more thorough evaluation of the migration of TCE

and related compounds from the Boeing property into, and in some locations *under*, the Montrose and Del Amo groundwater plumes. EPA is integrating the Boeing TCE migration into the highly refined groundwater flow and transport model being used to design and optimize the groundwater remedy. Decisions on placement of extraction and injection wells, regulation of pumping rates, and whether modifications to the containment provisions of the remedy are needed to address the TCE, will depend in part on sampling results from such wells and the associated modeling.

As you know, eight months after EPA's original request for such monitoring wells, Boeing has not installed the wells and has caused significant delay to the project. RWQCB-LA has indicated that it is considering assisting EPA by taking action to secure the installation and sampling of such wells. While not ruling out issuing our own enforcement orders, we appreciate being able to coordinate with you and consider whether State authorities may be able to provide the timely information that we, as well as RWQCB-LA, need with respect to off-property migration of contaminants from the Boeing property.

Per your request during our meeting, these are the objectives that EPA would seek to meet if the wells were to be installed and sampled pursuant to a RWQCB-LA action:

1. **Intent to Comply.** It is important to EPA not to lose valuable time in its schedule only to find that Boeing does not intend to comply with the RWQCB-LA order. We believe it would be important to receive from Boeing a written statement of their intent to comply with the order, ideally within 5-10 business days of receiving the order. Such a statement could be provided to the RWQCB and a copy forwarded to EPA.
2. **Well Locations.** Ideally, wells would be installed at the locations provided on the maps attached to this letter. The maps show more wells than EPA would request of Boeing. To be specific, we believe that the wells marked Gage1, Gage2, Gage3, Gage4, MBFC1, and MBFC2 should be installed by Boeing. If Boeing needs to change these locations to avoid obstructions, account for property access issues, or to address other technical needs, we request that we be consulted so that we can ensure that any modified locations still meet our needs. Two maps for each of the MBFC Sand and Gage Aquifer are provided; one zoomed out and one focused on the area of the wells.
3. **Well Protocols and Specifications.** We have attached to this letter an excerpt from Montrose's Work Plan for TCE Data Acquisition that provides the protocols, well construction specifications, screen depths and intervals, and well development details that would ensure that the wells are installed in a manner comparable to monitoring wells at the Montrose Chemical and Del Amo Superfund sites. It would be our hope that Boeing could use these protocols without having to spend the time and costs of preparing a separate work plan from scratch. We note that while this excerpt calls for the sonic drilling method and 2-inch diameter wells, we would also consider the mud rotary method and/or 4-inch diameter wells to be acceptable. Should these alternate methods be used, however, it would be important for Boeing to provide a description of their

method for performing borehole geophysical logging. We also note that this excerpt contains certain information specific to Montrose's field consultants, such as chain-of-command charts, which would not be applicable.

4. **Sampling and Analysis, and Water Levels.** The attached excerpt also provides provisions for sampling, analysis, and water level measurements. Following these provisions will ensure that the data obtained from the wells is comparable to that obtained from monitoring wells installed for the Montrose Chemical and Del Amo Superfund sites.
5. **Data Packages.** It is important that Boeing maintain laboratory documentation packages sufficient to allow an independent third party, such as EPA or RWQCB-LA, to perform a full data validation of laboratory quality control and quality assurance procedures for all samples, even if only a subset of the data is ultimately validated. Such documentation should allow a third party to view and verify all raw instrument output, instrument calibration, matrix spike/matrix spike duplicate results, and the attainment of all method and laboratory control criteria. EPA may be forced to reject data for which there is insufficient documentation of laboratory quality control to perform a full validation.
6. **Field Oversight and Split Sampling.** EPA intends to perform at least part-time field oversight of well installation and sampling procedures. EPA also intends to collect split samples from one or more of the new wells at the same time that Boeing samples the wells. It is therefore important that Boeing allow EPA (and its representatives, contractors, and assigns) access to the field work for these purposes upon EPA's direct request. In addition, we request that we be notified directly by Boeing at least 5 business days before the beginning field work and at the time of any change in the field schedule, so that we can plan for oversight and/or split sampling.
7. **Reports and Providing Interim Data.** We wish to receive a copy of any final report on well installation and sampling at the same time it is sent to RWQCB-LA. However, submittal of final reports from well installations can take an extended time. Because time is critical, we also wish to receive directly from Boeing, in advance of the report and as soon as they are available, interim copies of any laboratory results, water level measurements, as-built well construction details, wellhead elevations, geophysical logs, and hydrologic control data.
8. **Schedule.** In order to align with EPA's scheduling needs, EPA needs to receive the laboratory results, water levels, well construction details, wellhead elevations, geophysical logs, and hydrologic control data from these wells by May 31, 2005. This would provide enough time to install additional wells, should they be determined necessary based on the first set of wells, and for EPA to integrate the results with the modeling and design activities. This provides approximately 110 days from the issuance of an RWQCB-LA order for the wells to be installed and data to be at EPA, if the RWQCB issues such an order by about February 10, 2005. We would presume that the final report would follow within approximately 60 days, or by July 30, 2005.

I stress that EPA's remedial design schedule is already delayed due to the Boeing TCE contamination and obtaining the information from these wells in a time frame that is compatible with our schedule is critical. If actions considered by RWQCB-LA will not achieve this objective, EPA may choose to install the wells using its own funds and/or authorities. For this reason, it is very important that you contact me if you have questions or find that some or all of the above objectives or timetable cannot be met by the actions the RWQCB-LA is considering.

Once again, thank you for coordinating with us on this matter. We appreciate RWQCB-LA's support of our efforts to obtain vital information to address the contamination and effectively implement the ROD. If you have any questions, please do not hesitate to call me at (415) 972-3020.

Sincerely,

A handwritten signature in black ink, reading "Jeffrey A. Dhont". The signature is written in a cursive style with a long horizontal line extending from the end of the name.

Jeffrey A. Dhont  
Remedial Project Manager  
Superfund Division

cc: Safouh Sayed, DTSC  
Chia Rin Yen, DTSC  
Frank Gonzales, DTSC

## **ATTACHMENT 1: WELL LOCATION MAPS**

FORMER  
BOEING  
COMPANY

BL-10C  
14

BL-11C  
7.4

JONES  
CHEMICAL

FARMER  
BROTHERS

190th STREET

AMOCO  
CHEMICAL CO.

PACIFIC GATEWAY

KNOX STREET

DEL  
SI7

VERMONT AVE

204th STREET

TORRANCE BLVD

KENWOOD

GAGE 1

GAGE 2

G-21  
490

GAGE 3

GAGE 4

SWL0031  
1.9

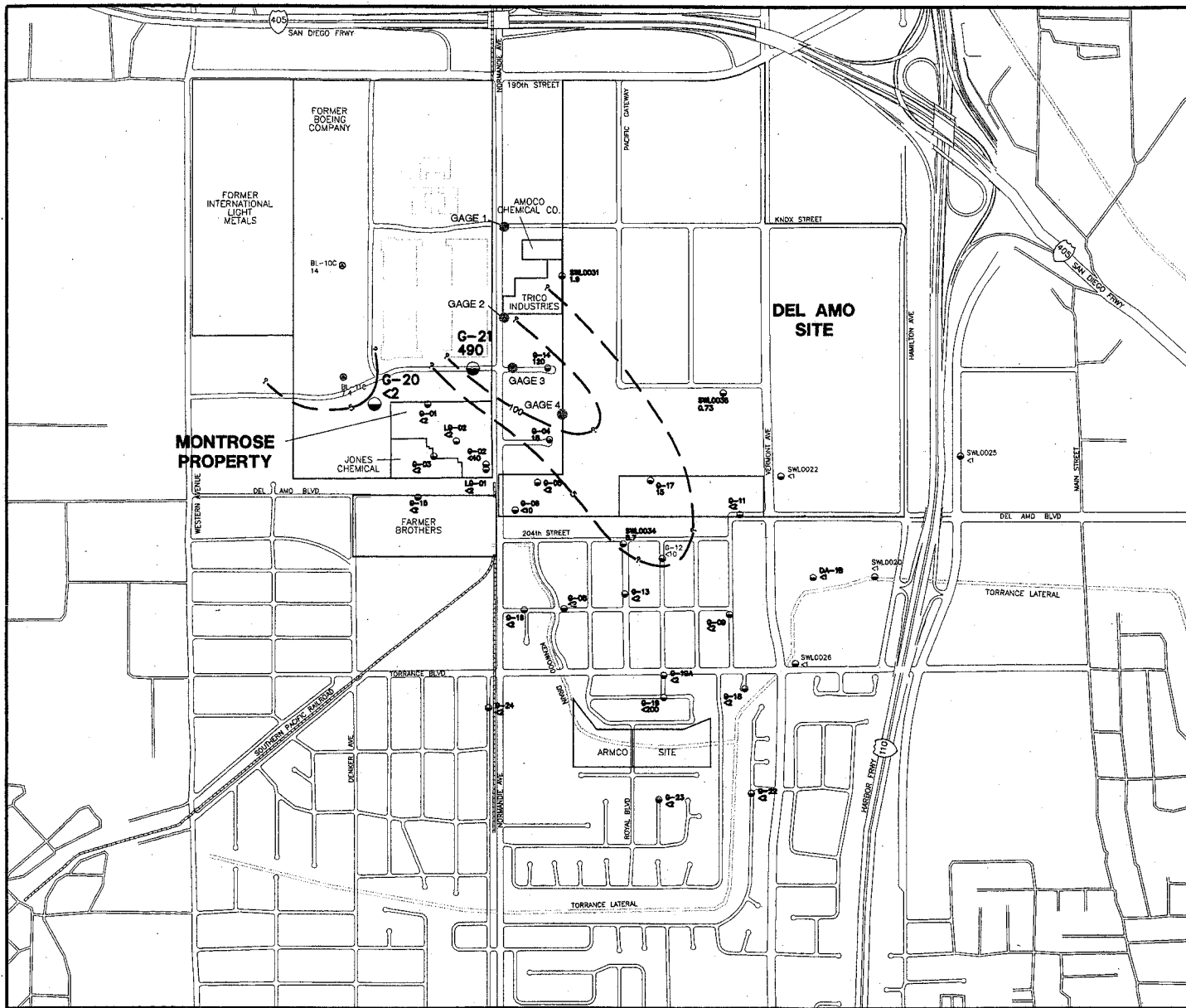
SWL0036  
0.73

SWL0022  
<1

SWL0034  
8.7

SWLC  
<1

G-19A



# EXPLANATION

G-04 GAGE AQUIFER MONITOR WELL  
 18 CONCENTRATION IN MICROGRAMS PER LITER, MONTROSE AND DEL AMO DATA FROM JANUARY-FEBRUARY, AND SEPTEMBER-NOVEMBER 2004, BOEING DATA FROM MAY 2004

<1 CONCENTRATION IN MICROGRAMS PER LITER, SAMPLED PRIOR TO JANUARY 2004  
 BL-11A CLUSTER WELL

— 5 —  
 CONTOUR LINE OF EQUAL CONCENTRATION OF TRICHLOROETHYLENE IN MICROGRAMS PER LITER  
 DASHED WHERE APPROXIMATE, QUERIED WHERE INFERRED

< = LESS THAN; NUMERICAL VALUE IS THE LIMIT OF DETECTION FOR THIS ANALYSIS.

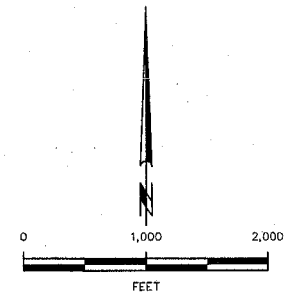
## IDENTIFIER NOTES:

G = MONTROSE MONITOR WELLS  
 SWL, DA = DEL AMO MONITOR WELLS  
 BL = BOEING-LOCKHEED MONITOR WELL  
 DP = ILM DIRECT PUSH GROUNDWATER SAMPLE LOCATION

NOTE:  
 CONCENTRATION DATA FOR DEL AMO MONITOR WELLS PROVIDED BY URS, 2004.

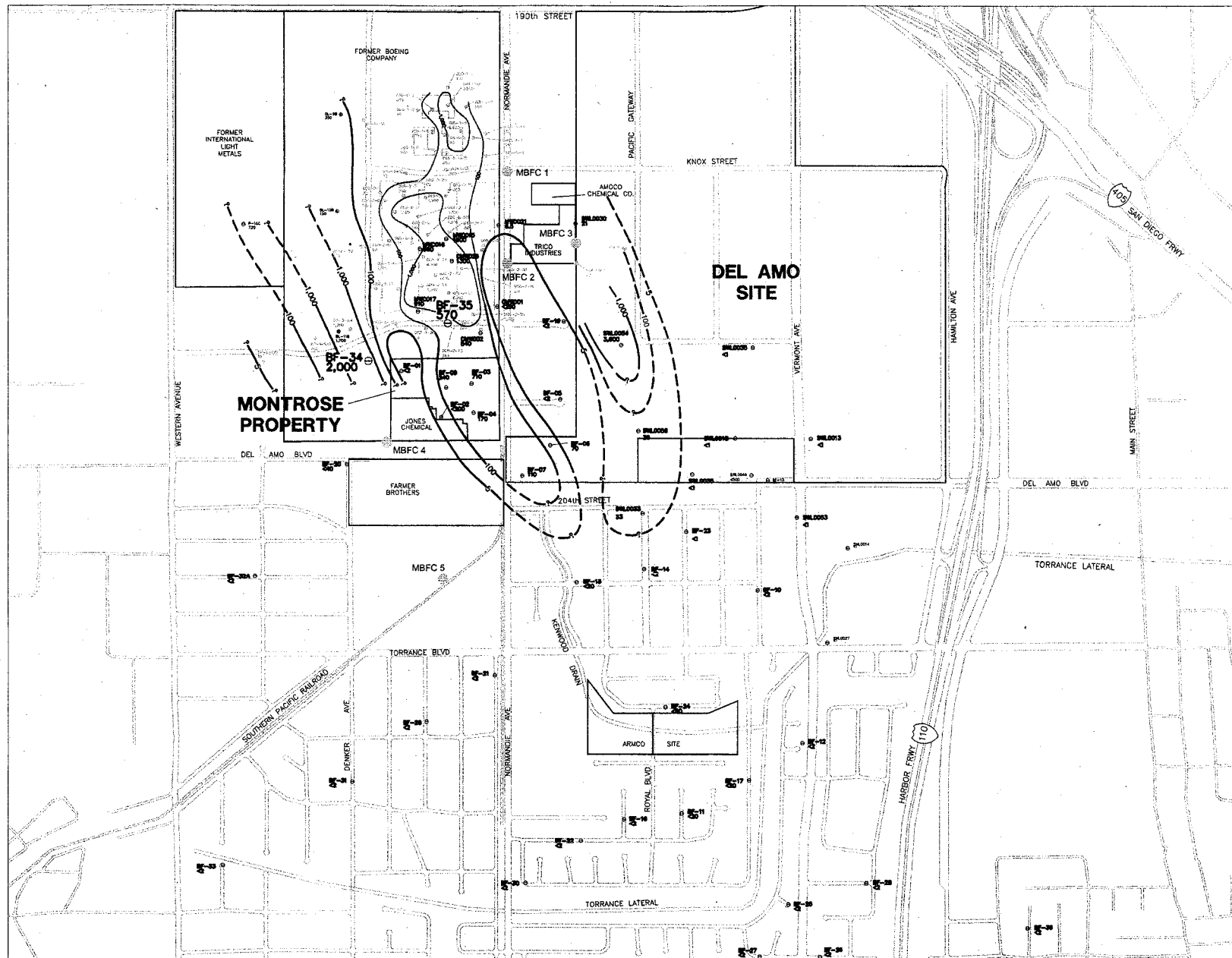
WATER QUALITY DATA PRESENTED ON THIS MAP ARE THE MOST RECENT DATA AVAILABLE FOR EACH WELL. DATA FOR MONTROSE WELLS WERE SUPPLEMENTED WITH AVAILABLE DATA OBTAINED BY OTHERS FROM NON-MONTROSE MONITOR WELLS LOCATED IN THE SITE VICINITY.

PROPOSED EXPLORATORY BORING WITH HYDROPUNCH  
 SAMPLE AND/OR MONITORING WELL



Proposed Wells

GAGE AQUIFER



- BF-18 BELLFLOWER SAND MONITOR WELL
- 
- 
- CONCENTRATION IN MICROGRAMS PER LITER, SAMPLED FROM TO JANUARY 2004
- DIRECT PUSH GROUNDWATER SAMPLE LOCATION
- CLUSTER WELL

CONTOUR LINE OF EQUAL CONCENTRATION OF TRICHLOROETHYLENE IN ug/L (ADAPTED FROM HALEY & ALDRICH, SITE-WIDE GROUNDWATER ASSESSMENT REPORT, OCTOBER 2002)

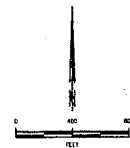
CONTOUR LINE OF EQUAL CONCENTRATION OF TRICHLOROETHYLENE IN MICROGRAMS PER LITER (DASHED WHERE APPROXIMATE, DOTTED WHERE INFERRED)

- < = LESS THAN NUMERICAL VALUE IS THE LIMIT OF DETECTION FOR THE ANALYTES
- NA = NOT ANALYZED
- ug/L = MICROGRAMS PER LITER

DESCRIPTIVE NOTES:  
 BF = MONTROSE MONITOR WELLS  
 MBFC = DEL AMO MONITOR WELLS  
 P = SAN MONITOR WELLS  
 DPG = BOEDING DIRECT PUSH GROUNDWATER SAMPLE LOCATION  
 DP = SAN DIRECT PUSH GROUNDWATER SAMPLE LOCATION  
 MW, CW, ICC = BOEDING MONITOR WELL

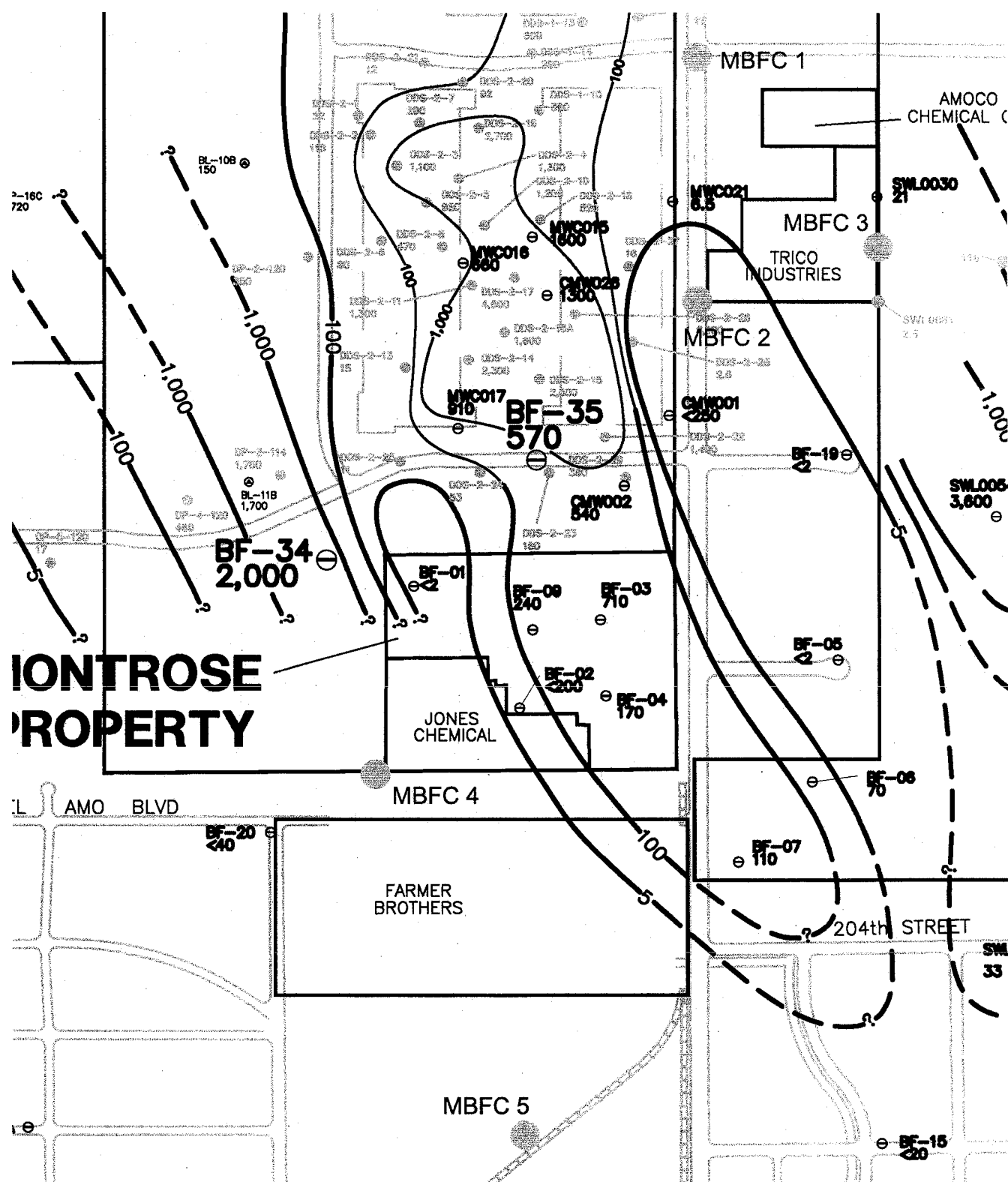
NOTE: CONCENTRATION DATA FOR DEL AMO MONITOR WELLS PROVIDED BY JUL 2004.  
 BEST QUALITY DATA PROVIDED ON THIS MAP ARE THE MOST RECENT DATA AVAILABLE FOR EACH WELL AS OF MAY 2004. DATA FOR MONTROSE WELLS WERE SUPPLEMENTED WITH AVAILABLE DATA OBTAINED BY OTHERS FROM NON-MONTROSE MONITOR WELLS LOCATED IN THE SITE VICINITY.

PROPOSED EXPLORATORY BORING WITH HYDROPUNCH SAMPLE AND/OR MONITORING WELL



Proposed Wells
BELLFLOWER SAND





OUTSTANDING  
QUALITY CONTROL BOARD  
LOS ANGELES REGION

2005 FEB -3 PM 2:13

## **ATTACHMENT 2: WELL INSTALLATION; SAMPLING AND QA/QC PROTOCOLS**

Excerpt from

*Work Plan for TCE Data Acquisition, June 29, 2004*  
(with Field Sampling Plan and Quality Assurance Plan)



HARGIS + ASSOCIATES, INC.

APPENDIX A

FIELD SAMPLING PLAN  
TCE PLUME DATA ACQUISITION  
MONTROSE SITE  
TORRANCE, CALIFORNIA

2005 FEB -3 PM 2:13  
QUALITY CONTROL  
LOS ANGELES REGION

2005 FEB -3 PM 2:13

APPENDIX A  
FIELD SAMPLING PLAN  
TCE PLUME DATA ACQUISITION  
MONTROSE SITE  
TORRANCE, CALIFORNIA

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ACRONYMS AND ABBREVIATIONS

ASTM	American Society of Testing and Materials
BHC	Hexachlorocyclohexane
bls	Below Land Surface
D&M	Dames & Moore
DDT	Dichlorodiphenyltrichloroethane
DO	Dissolved oxygen
EC	Electrical conductivity
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan
H+A	Hargis + Associates, Inc.
ID	Internal diameter
LNAPL	Light nonaqueous phase liquid
MACP	Monitoring and Aquifer Compliance Plan
ml	Milliliter
Montrose	Montrose Chemical Corporation of California
msl	Mean sea level
NTUs	Nephelometric Turbidity Units
ORP	Oxidation-reduction potential
pCBSA	parachlorobenzene sulfonic acid
Property	Area within the fenced property boundary located at 20201 South Normandie Avenue, in Los Angeles (near Torrance), California
PVC	Polyvinyl chloride
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RI	Remedial Investigation
ROD	Record of Decision
Site	Montrose Chemical Corporation of California site
SOP	Standard operating procedure
SOW	Scope of Work



ACRONYMS AND ABBREVIATIONS (continued)

TCE	Trichloroethylene and the family of chlorinated solvents referred to in the ROD
UAO	Unilateral Administrative Order
USCS	Unified Soil Classification System
VOCs	Volatile organic compounds
Workplan	TCE Plume Data Acquisition Workplan



## APPENDIX A

### FIELD SAMPLING PLAN TCE PLUME DATA ACQUISITION MONTROSE SITE TORRANCE, CALIFORNIA

#### 1.0 PROJECT DESCRIPTION

This Field Sampling Plan (FSP) has been prepared for Montrose Chemical Corporation of California (Montrose) in accordance with the requirements outlined in Section 1.1 of the Unilateral Administrative Order (UAO) Statement of Work (SOW), First Amendment (U.S. Environmental Protection Agency [EPA], 2004). This FSP describes the objectives, rationale, methods, and procedures for monitoring well drilling and construction, well development, water level measurement, and groundwater sampling for the Trichloroethylene (TCE) Plume Data Acquisition program to be conducted at the Montrose site (Site). This FSP is a companion document to the Workplan for TCE Plume Data Acquisition (Workplan) and the associated Quality Assurance Project Plan for TCE Plume Data Acquisition (QAPP).

This FSP was developed in accordance with the EPA guidance document "Preparation of a U.S. EPA Region 9 Field Sample Plan for EPA-Lead Superfund Projects", Document Control No. 9QA-06-93" (EPA, 1994).

#### 1.1 DEFINITION OF TERMS

To facilitate the discussion within this document, several defined terms are used as described below. For clarity of discussion only, this report will refer to the "Property" as the area within the fenced property boundary located at 20201 South Normandie Avenue, in Los Angeles, near



Torrance, California (Figure A-1). The term "central process area" refers to an approximate two acre portion of the Property where most of the manufacturing operations were performed historically.

The term TCE as used in this work plan refers to trichloroethylene and the family of chlorinated solvents as described in the Record of Decision (ROD) for this site (EPA, 1999). In addition, the term dichlorodiphenyltrichloroethane (DDT) or total DDT, will be used to refer to the sum of the isomers and metabolites of DDT. The term hexachlorocyclohexane (BHC) or total BHC, will be used to refer to the sum of the isomers of BHC.

## 1.2 OBJECTIVES AND SCOPE

In accordance with the UAO SOW Section 1.1.1, the objectives of the Workplan, and the associated FSP and QAPP are to:

- Provide a description of the current data on the TCE plume distribution and potential sources.
- Provide an identification of current data gaps with respect to the distribution and potential sources of the TCE plume to assist in directing the acquisition of additional data.
- Provide the identification and rationale for the number and locations of monitoring wells to be installed to meet the requirements of the ROD with respect to the TCE plume.
- Identify the property owners at the proposed well locations and any anticipated issues regarding long-term and short-term property access.
- Provide a complete description of proposed well construction details, drilling methods and equipment, construction materials, borehole, casing and annular spacing measurements; depths of screened and blank casing intervals, proposed pump, transducers and other dedicated or temporary downhole equipment.



- Provide a description of well development procedures.
- Provide a description of the treatment and/or disposal of development water, drilling fluids and other potentially contaminated media.
- Provide the groundwater sampling procedures and chemical and physical parameters to be included in the sample analysis of the new wells, pending incorporation into the overall monitoring plan.

The first four bullets are addressed in the accompanying Workplan. The last four bullets are addressed in this FSP.

### 1.3 OVERVIEW OF THE FIELD EFFORT

Five new monitor wells will be installed as part of this field effort in order to meet the objectives of UAO SOW (EPA, 2004). Water level measurement and groundwater sampling of the new wells will also be conducted in accordance with the Workplan. Water levels will be measured twice and groundwater samples will be collected twice from each new well.

### 1.4 DATA NEEDS AND USES

Data needs and the intended uses of the data to be collected are presented below. A QAPP has been prepared for sampling to be conducted as part of this FSP. The QAPP is included as Appendix B of the Workplan.

A summary table of data uses and limitations for this program is presented in Table A-1.

Water quality data will be collected to assess the distribution and lateral and vertical extent of the TCE plume within the upper Bellflower aquitard, Bellflower sand, and the Gage aquifer upgradient of the Site. In order to meet the sampling objectives outlined in Sections 1.2, 4.1.1,



4.2.1, and 4.3.1 groundwater samples will be analyzed for volatile organic compounds (VOCs) using EPA Method 8260B (Table A-2). As part of the baseline sampling of these wells, groundwater samples will also be collected for analysis of DDT, BHC and other organochlorine pesticides using EPA Method 8081A, parachlorobenzene sulfonic acid (pCBSA) using modified EPA Method 314, general minerals and California title 22 metals in accordance with the appropriate EPA methods.



## 2.0 BACKGROUND

Background information related to the Site and previous groundwater investigations are outlined in Sections 2.1 through 2.5.

### 2.1 SITE LOCATION AND DESCRIPTION

The Property occupies approximately 13 acres in the City of Los Angeles near Torrance, California (Figures A-1 and A-2). The Property is bounded by the Union Pacific Railroad right-of-way and Normandie Avenue to the east; Jones Chemical Company and a right-of-way owned by the Los Angeles Department of Water and Power to the south; and the former Boeing Realty Corporation to the north, and Frito-Lay to the west. The Property is generally flat. Elevations range from 40 feet above mean sea level (msl) to 45 feet msl. The surrounding area consists of mixed residential, commercial, and industrial facilities. The property is accessible by city streets in the area and Interstates 405 and 110. The Los Angeles International Airport is located approximately 10 miles from the property.

### 2.2 STRATIGRAPHY

The stratigraphy of the Site was defined using published regional geologic data and by site-specific data collected from monitor wells and borings drilled during multiple Site investigations. For more information about the stratigraphy at the Site, the reader is referred to the Remedial Investigation (RI) report (EPA, 1998).

The stratigraphy of the Site starting at land surface consists of fill material, the Playa deposits, the Palos Verdes sand, the Bellflower aquitard, the Gage aquifer, an unnamed aquitard, and the Lynwood aquifer. Three geologic units comprise the vadose zone encountered at the Site:



recent Playa deposits, late Pleistocene marine deposits referred to as the Palos Verdes sand, and the upper portion of the Pleistocene Bellflower aquitard.

Fill material consisting of moderately to highly plastic dark brown clay with occasional brick and concrete debris is generally encountered from land surface to approximately 4 feet below land surface (bls) on-property. On the pads, fill material is generally encountered from land surface to approximately 8 feet bls. In the vicinity of the former water recycling pond in the CPA, fill material is approximately 20 feet thick. The Playa deposits, consisting of olive-brown silty sand, sandy silt, and silt are generally encountered beneath the fill material to a depth of approximately 22 feet bls. The Palos Verdes sand, consisting of a fine-grained, light yellowish brown to light olive-brown, well sorted sand, is generally encountered to a depth of approximately 44 feet bls. A well-cemented fossiliferous sand is encountered at the base of the Palos Verdes sand. This cemented fossiliferous sand is thickest in the western portions of the Property, and appears to dip slightly and pinch out toward the east. The thickness of this unit in the western portion of the Property was approximately 8 feet and was approximately 2 feet in the eastern portion of the Property.

The Bellflower aquitard immediately underlies the Palos Verdes sand. Three lithologically distinct subunits of the Bellflower aquitard are encountered at the Site: the upper Bellflower aquitard, the Bellflower sand, and the lower Bellflower aquitard. The first groundwater beneath the Site is encountered within the upper Bellflower aquitard at a depth of approximately 65 feet bls. The upper Bellflower aquitard consists of fine-grained sand, silty sand, silt and clay. These sediments are interbedded, discontinuous, and vary in thickness. The upper Bellflower aquitard is encountered to a depth of approximately 100 feet bls. The Bellflower sand underlies the upper Bellflower aquitard. The Bellflower sand is a fine- to medium-grained sand. The Bellflower sand is encountered to a depth of approximately 130 feet bls. The lower Bellflower aquitard, consisting of a brown silty sand and silt, is encountered beneath the Bellflower sand to a depth of approximately 140 feet bls.

The Gage aquifer, consisting of fine-grained sand, is encountered beneath the lower Bellflower aquitard to a depth of approximately 220 feet bls. An unnamed aquitard underlying the Gage aquifer has been informally named the Gage-Lynwood aquitard. It consists of silt, sandy silt,



and/or clayey silt interbedded with fine-grained silty sand and appears to be laterally continuous across the Site.

The upper 20 feet of the Lynwood aquifer consists of dark gray fine- to medium-grained sand. This sand is frequently underlain by as much as 8 feet of dark gray silt or clay of varying plasticity. Approximately 10 to 30 feet of gray, well-graded sand, gravelly sand, and sandy gravel with some silty sand interbeds underlie the top 20 to 30 feet of the Lynwood aquifer. The Lynwood aquifer occurs approximately between 270 to 305 feet bls across the Site. The thickness of the Lynwood aquifer, based on borings drilled at the Site, varies from 33 feet to greater than 108 feet.

An unnamed aquitard, approximately 205 feet thick beneath the Site, separates the Lynwood aquifer and the underlying Silverado aquifer beneath and east of the Site. The Silverado aquifer consists of fine- to coarse-grained blue-gray sands and gravels with discontinuous layers of silt and clay. These deposits reportedly attain a maximum thickness of about 500 feet.

### 2.3 HYDROGEOLOGY

Most of the recharge to the West Coast Basin aquifers occurs at the West Coast Barrier Project and the Dominguez Gap Barrier Project. Fresh water is injected into a line of injection wells that parallels the coastline. The injected water forms a freshwater pressure ridge that acts as a barrier to protect basin groundwater from saltwater intrusion. A slight seaward flow of groundwater is maintained between the barrier and the ocean that prevents intrusion of seawater. Most of the injected water flows from the barrier toward the interior of the basin.

The regional direction of groundwater flow within the West Coast Basin is controlled by the injection barriers and pumping centers. The predominant flow direction in the Silverado Aquifer is to the east from the West Coast Basin Barrier Project to pumping centers located in Gardena, Wilmington, and Carson.

The groundwater flow direction in the upper Bellflower aquitard during September 2002 was somewhat variable in the region north the Montrose Site, varying locally from south-southwest



to south-southeast. In the area south of the Montrose property, the direction of groundwater flow was mainly toward the southeast. Between 1988 and 1995, the direction of groundwater flow in the upper Bellflower aquitard has varied between south and south-southeast (H+A, 2002). In general, the groundwater flow direction in the upper Bellflower aquitard south of the property in January 2004 was to the south and southeast, but varied locally (H+A, 2004b).

The direction of groundwater flow in the Bellflower sand in the vicinity of the Montrose Site during September 2002 was to the southeast. The regional direction of groundwater flow in the Bellflower sand has been relatively consistent since 1987 (H+A, 2002). In general, the groundwater flow direction in the Bellflower sand south of the property in January 2004 was to the southeast (H+A, 2004b).

The direction of groundwater flow in the Gage aquifer during September 2002 was approximately east-southeast and appears to be uniform across the Montrose Site. The direction of groundwater flow in September 2002 was generally consistent with the direction of groundwater flow observed during the period 1987 through 1995 (H+A, 2002). In general, the groundwater flow direction in the Gage aquifer south of the property in January 2004 was to the southeast (H+A, 2004b).

## 2.4 SITE HISTORY

Montrose manufactured DDT at the Site from 1947 to 1982. The facility was closed in 1982 and the Site subsequently cleared and capped. Previous investigations addressing the potential for contamination at the Site included on- and off-property sampling of soil, groundwater, sediment, and surface water. The investigations were performed by the EPA, its contractors, the California Department of Health Services, the Regional Water Quality Control Board, and Montrose's consultants. The RI Report provides a detailed summary of the Site history (EPA, 1998).



## 2.5 PREVIOUS INVESTIGATIONS

Groundwater monitoring has been conducted by Montrose since 1985. A total of 97 monitor and extraction/test/injection wells were originally constructed as part of RI activities conducted by Montrose to evaluate the nature and extent of Montrose-related compounds in groundwater (Figure A-2). A number of monitor wells have been destroyed by different entities during construction, grading, or paving activities on surrounding properties. Presently there are 85 monitor wells and six extraction/test/injection wells at the Site (Table A-3).

Quarterly groundwater monitoring of all Montrose monitor wells was conducted until 1990, when an EPA-approved key well monitoring program was implemented and frequency of monitoring, the number of sampling locations, and the level of documentation required were reduced (EPA, 1998). The number of sampling locations and number of analytes for the key well monitoring program were further reduced to 11 wells in 1992. The key well monitoring program concluded in January 1993. Limited groundwater sampling was done between 1995 and 2002. A baseline groundwater sampling round was conducted in January 2004 (H+A, 2004b).

In addition to the Montrose RI, other groundwater contamination investigations have been conducted by other parties in the vicinity of the Montrose site. In particular, an RI has been conducted at the adjacent Del Amo Site by Dames & Moore (D&M) on behalf of the Del Amo respondents. For additional information, please refer to the RI Report or the most recent monitoring report (D&M, 1998; URS, 2004).

Montrose monitor wells are screened in each of the following four hydrostratigraphic zones, which are identified in order of increasing depth below land surface (bls):

- Upper Bellflower aquitard;
- Bellflower sand;
- Gage aquifer; and
- Lynwood aquifer.

Detailed discussion and conclusions regarding hydrostratigraphic interpretations, directions of groundwater flow, and the nature and extent of contamination in each of these

hydrostratigraphic zones are provided in the RI Report (EPA, 1998). The RI Report also describes the historical background; history of response; assessment objectives; assessment results; laboratory analyses; quality assurance; fate and transport of compounds of concern; and other pertinent information, such as aquifer test results, well construction, and well development specifications. Due to the comprehensive and extensive nature of supporting documentation, information contained in the Montrose RI Report is frequently incorporated by reference in this FSP and has not been duplicated herein.

Information regarding the previous investigations at the former Boeing site and the former International Light Metals site are provided in the Workplan.

### 3.0 MAPS AND FIGURES

For ease of use in the field, the figures described in this section have been compiled together into a single section behind the tab marked "Figures" which follows the text and tables sections of this FSP. A list of these figures can be found in the Table of Contents, which precedes the text portion of this FSP.

- **FIGURE A-1. SITE LOCATION:** This figure shows the location of the Property relative to the major freeways and cities in the greater Los Angeles metropolitan area. The figure also provides the reader with a perspective of the location of the Property within the State of California.
- **FIGURE A-2. MONITOR WELL LOCATIONS:** This figure depicts the outline of the Property and the locations of monitor wells currently installed at the Property and elsewhere at the Site and vicinity. Also depicted on this figure, for reference, is the local surrounding area including adjoining streets, rights-of-way, and railroad locations. The central process area, the area located near the center of the Property where the majority of the manufacturing occurred during the period of plant operations, is also depicted on Figure A-2.
- **FIGURE A-3: PROPOSED WELL LOCATIONS:** This figure illustrates the proposed well locations to be drilled in the area by both Boeing Realty Corporation and Montrose.
- **FIGURE A-4: MONITOR WELL SCHEMATIC:** This figure illustrates the proposed construction details for new monitor wells to be installed within the upper Bellflower aquitard, Bellflower sand, and Gage aquifer. Although the drilling method and depth intervals for these wells will differ, the basic well design is generally similar.
- **FIGURE A-5: HOSPITAL ROUTE:** This figure was derived from the project-specific Health and Safety Plan and depicts the route to the hospital in the event that a medical emergency should arise during the field program described in this FSP (H+A, 2003).



## 4.0 RATIONALE FOR SAMPLING AND ANALYSIS PLAN

The following sections describe the objectives and rational for the drilling and construction of new monitor wells,, measurement of water levels, and collection and analysis of groundwater samples from the new monitor wells.

### 4.1 MONITOR WELL DRILLING AND CONSTRUCTION

#### 4.1.1 Objectives

Five new monitor wells will be installed to provide more complete characterization of the extent of the TCE plume at the Site in order to fulfill the requirements of Task 1.1.1 of the UAO SOW. Details regarding the objectives for each of the proposed wells have been provided in the Workplan Section 4.1.

#### 4.1.2 Frequency and Location

Locations of existing monitor wells are shown in Figure A-2. Proposed locations of new monitor wells are shown on Figures A-3.

### 4.2 WATER LEVEL MEASUREMENT

#### 4.2.1 Objectives

The objectives of measuring water levels are to provide data to evaluate groundwater levels and groundwater flow conditions at each new monitor well location. Water level data will be used to evaluate horizontal and vertical hydraulic gradients, the direction of groundwater flow, and their potential impact on the current and future distribution of the TCE plume.



#### 4.2.2 Frequency and Location

Water levels will be measured twice for each new monitor well. The first round of water level measurements will be conducted following monitor well construction and development, prior to collection of the initial groundwater samples. The second round of water level measurements will be conducted approximately two weeks following the initial round of measurements, in conjunction with the second round of groundwater samples. Subsequent water level measurements will be conducted in accordance with the requirements outlined in the Monitoring and Aquifer Compliance Plan (MACP), which is being prepared by EPA.

### 4.3 GROUNDWATER SAMPLING FOR NEW MONITOR WELLS

#### 4.3.1 Objectives

In accordance with the UAO SOW Task 1.1.1, the objective of the TCE Plume Data Acquisition work is to provide more specific information regarding the horizontal and vertical extent of TCE required for the design of the remedial action. Two rounds of groundwater samples will be collected from the proposed monitor wells as part of the TCE Plume Data Acquisition work to fulfill the specific objectives listed in Section 1.2.

#### 4.3.2 Frequency and Locations

An initial round of groundwater samples will be collected after monitor well construction and development has been completed. Groundwater samples collected during the initial round will be analyzed for VOCs, pCBSA, organochlorine pesticides, metals and general minerals to provide baseline information regarding general water quality as well as the nature and extent of VOCs in the area upgradient of the Property.

The second round of groundwater samples will be collected approximately two weeks following the initial round of groundwater sampling. This will allow sufficient time to review the preliminary laboratory results from the initial round prior to conducting the second groundwater sampling round. Groundwater samples collected during the second groundwater sampling round will be



analyzed for VOCs to confirm the distribution of TCE and other VOCs obtained during the first round. The results from the second round of groundwater sampling will be used to confirm the concentrations of VOCs reported from the first round, and to provide a higher level of confidence in the analytical results.

Future sampling of the wells installed as part of the TCE Plume Data Acquisition will be done in accordance with the sampling schedule of the MACP, which is being prepared by EPA.



## 5.0 REQUEST FOR ANALYSES

This section describes the parameters to be analyzed and the methods to be used during groundwater sampling of newly installed wells for the TCE Plume Data Acquisition program.

Original, field duplicate groundwater samples, field blank, and trip blank water samples, will be analyzed by Del Mar Analytical, Irvine, California. Laboratory split groundwater samples and associated trip blank samples will be analyzed by West Coast Analytical Services, Inc., Santa Fe Springs, California.

### 5.1 VOLATILE ORGANIC COMPOUNDS

Groundwater samples collected from new monitor wells will be analyzed for chlorobenzene, TCE and other VOCs using EPA Method 8260B (Table A-2). For any sample requiring dilution, the laboratory will be instructed to report both the diluted and the non-diluted results for VOCs.

### 5.2 pCBSA

Groundwater samples collected from new monitor wells will be analyzed for pCBSA using Modified EPA Method 314 (Table A-2).

### 5.3 OTHER PARAMETERS

Groundwater samples collected from selected Site monitor wells will be analyzed for DDT and its isomers and metabolites, BHC isomers, and other organochlorine pesticides using EPA Method 8081A (Table A-2). Groundwater samples will be collected from selected Site monitor wells for general minerals and California Title 22 metals in accordance with the appropriate EPA method (Table A-2).





## 6.0 FIELD METHODS AND PROCEDURES

Standard operating procedures for monitor well drilling and construction, well development, groundwater sampling and water level measurement are provided.

### 6.1 MONITOR WELL DRILLING AND CONSTRUCTION

#### 6.1.1 Equipment and/or Instrumentation

The upper Bellflower aquitard monitor wells proposed as part of the TCE data acquisition program will be installed using a hollow stem auger drill rig. The Bellflower sand and Gage aquifer monitor wells proposed as part of the TCE data acquisition program will be installed using the sonic drilling method. This drilling method provides continuous core of the interval penetrated and generates minimal cuttings and no drilling mud.

Preliminary well construction specifications for the proposed new monitor wells are provided (Table A-4). The upper Bellflower aquitard monitor wells will be completed with 4-inch diameter Schedule-40 PVC casing and screen (Figure A-4).

Based on an evaluation of the distribution of contaminants in the overlying hydrostratigraphic units, the proposed Bellflower sand and Gage monitor wells have the potential to penetrate zones of elevated TCE contamination. To prevent potential cross contamination from the overlying zones during drilling, a conductor casing will be installed and grouted in place to seal off the contaminated zones prior to drilling into the target completion zones for these wells. Due to limitations regarding borehole diameter using the sonic drilling method, proposed Bellflower sand and Gage monitor wells will be completed with 6-inch steel conductor casing and two-inch diameter Schedule 40 PVC casing and screen (Figure A-4).

Equipment used as part of lithologic logging may include any or all of the following: hand lens, dropper bottle containing dilute hydrochloric acid, Munsell color chart, sand size chart, sample



collection bags, wire mesh sieves, and pocket knife. Reference materials such as American Geologic Institute Data Sheets for Field Geology (Dietrich, et al., 1982), Manual of Field Geology (Compton, 1962), or Earth Manual (U.S. Department of Interior, 1980) may be used.

#### 6.1.2 Preparation

Essential field equipment and supplies will be ordered prior to commencing drilling, lithologic logging, and well construction. Available references relating to the Site vicinity such as lithologic logs, geologic reports, and other information from previous site assessments should be reviewed to evaluate the nature of the study area geology.

A qualified driller will be selected to drill well borings, and to install the wells. A qualified driller will have appropriate equipment capabilities, a California C-57 license, experience on similar projects, and documentation of health and safety training. This experience requirement shall apply both to the individual driller in the field and to the drilling company as a whole.

Prior to entering the field, authorized personnel will contact property owners and applicable agencies to obtain and comply with regulatory requirements regarding permits, access, drilling, and underground utility clearance, if required.

#### 6.1.3 Standard Operating Procedures

Standard operating procedures (SOPs) for drilling, lithologic logging, and well installation are detailed in the following sections.

##### 6.1.3.1 Lithologic Logging

A lithologic log will be compiled during drilling of monitor well boreholes. The following procedures will be used during lithologic logging activities:

- Describe the soil sample or drill cuttings and record in field notebook. Take into account alterations caused by the sampling or drilling process.



- Note unusual drilling conditions or rig behavior.

The following procedures will be used for lithologic description of soil samples or drill cutting samples:

- Textural Classification of Soil:
  - Record the ratio of the following grain size fractions present in the sample to the nearest five percent: gravel, sand, and fines (silt and clay). The size limits for each fraction will be in accordance with the Unified Soil Classification System (USCS) Visual-Manual Procedure D-2488-84 [American Society for Testing and Materials (ASTM), 1984]. Estimate and record the predominant grain size(s) present within the gravel and sand fractions in the sample.
  - Provide textural classification name for the soil/sediment and classify the soil/sediment using the USCS. The root of the name is determined by the highest percentage of gravel, sand, silt, or clay fractions. The modifying terms are based on the relative percentage of the other major size fractions in the sample. A major size fraction is defined as a textural fraction that constitutes 30 percent or more of the sample, by volume. For example, a sample containing 90 percent sand and 10 percent silt would be classified as a sand with silt. Record the appropriate USCS classification on the lithologic log form.
- Color:
  - Compare sample to Munsell color chart and provide hue and chroma values for moist soil samples. Indicate in the field notebook if the color was determined based on a dry sample. Record the Munsell color descriptor.
- Moisture Content:



- For soil/sediment samples collected using drilling methods that do not involve introduction of fluids, estimate relative moisture content using the terms "dry", "moist", and "wet".
- Consistency or Relative Density:
  - Estimate the consistency or relative density of the sample based on rig hammer blow counts, examination of samples, and on observation of the drilling characteristics of the soil/sediment. Consistency descriptors for fine-grained soils/sediments are: very soft, soft, firm, stiff, very stiff, and hard. Relative density descriptors for coarse-grained soils/sediments are: very loose, loose, medium dense, dense, and very dense. Descriptors of the degree of induration for a soil/sediment as a whole are: poorly indurated, moderately indurated, and well indurated.
- Plasticity:
  - Determine the degree of plasticity for fine-grained lithologic samples. Plasticity is the property in which a soil/sediment can be rapidly deformed or molded without rebounding elastically, changing volume, cracking, or crumbling (ASTM, 1984). Plasticity descriptors are: nonplastic, low plasticity, medium plasticity, and high plasticity.
- Sorting:
  - Estimate the degree of sorting, or overall grain size distribution, of soil/sediment samples that consist predominantly of sand-sized or larger particles. Designate by using one of the following descriptors: poorly sorted, moderately sorted, and well sorted. The descriptor "poorly sorted" applies to soils/sediments in which there is a good representation of the continuum of particle sizes. The descriptor "well sorted" applies to soils/sediments in which most particles are about the same size.
- Roundness:



- Estimate the predominant roundness categories for the sand and gravel size fractions according to the roundness scale (Dietrich et al., 1982). The roundness categories are: angular, subangular, subrounded, and rounded. The on-site hydrogeologist will record in the field notebook actions of drilling bits or auger flights that may be responsible for increasing the angularity of the sand or gravel size fractions in the sample, if applicable.
- **Miscellaneous Properties:**
  - Additional properties should be reported if noted in the soil/sediment sample. These properties include the following: mineralogical composition; degree of iron or manganese staining of coarse fraction; reactance with dilute hydrochloric acid; odor; other physical properties, including soil structure and fracture spacing and width, if applicable; orientation and coatings on fractures, if applicable; presence of man-made, animal, or plant material; and organic vapor readings determined using equipment such as an organic vapor analyzer.
- **Core Recovery:**
  - Record core recovery - ratio of the length of core recovered to the total length of the core run.

#### 6.1.3.2 Monitor Well Boreholes

Information regarding borehole diameters and depths for proposed monitor wells are provided (Table A-4). The borehole for proposed upper Bellflower aquitard monitor wells will be drilled using a hollow stem auger drill rig. Initially, a pilot hole will be continuously cored to the target depth. The borehole will then be reamed to a 10- or 12-inch diameter. The borehole depth may be adjusted depending on the lithology encountered. The upper Bellflower aquitard monitor wells will be completed with 4-inch diameter Schedule-40 PVC casing and screen (Figure A-4).



The boreholes for the Bellflower sand and Gage aquifer monitor wells proposed as part of the TCE data acquisition program will be advanced using a sonic drill rig. This drilling method provides continuous core of the interval penetrated and generates minimal cuttings and no drilling mud. The sonic method has been successfully employed at the Montrose property without experiencing significant problems such as heaving sand conditions.

The proposed Bellflower sand, and Gage aquifer monitor wells will be constructed using conductor casing. The conductor casing borehole will be advanced using a 10-inch-diameter drill casing. As the target aquitard overlying the completion zone is approached the core runs will be reduced to three- to five-foot intervals. Once the target aquitard overlying the completion zone is encountered, drilling will be immediately halted and the conductor casing will be installed. The bottom of the conductor casing will be fitted with a drillable plug and filled with clean water to prevent the exchange of groundwater that may enter the borehole during drilling. The conductor casing annulus will be pressure grouted by pumping neat cement through a tremie pipe set to the bottom of the borehole. The sonic drill casing will then be removed and the cement grout will be allowed to set for a minimum of 24 hours before drilling into the target completion zone and installing the well.

Detailed lithologic data will be obtained during the hollow stem auger and sonic drilling, which will be used to confirm the screen intervals and slot size and filter pack for each of the proposed wells. Monitor well design, drilling, lithologic logging, and well construction will be conducted under the supervision of a California Registered Geologist. Monitor wells will be designed in accordance with the procedures outlined in the FSP, Department of Water Resources guidelines, and with applicable County of Los Angeles regulations.

#### 6.1.3.3 Upper Bellflower Aquitard Monitor Wells

Monitor wells constructed in the upper Bellflower aquitard will be screened across the water table and will be drilled and constructed using hollow stem auger drilling methods.

Monitor wells will be constructed with a nominal 4-inch inner diameter (ID) schedule 40 polyvinyl chloride (PVC) blank well casing and 15 feet of schedule 40 PVC 0.020-inch factory slotted well



screen. This screen length is consistent with the other upper Bellflower aquitard monitor wells in the vicinity. Due to anticipated lower concentrations of TCE in the proposed monitor wells, PVC well screens are proposed. The proposed monitor wells will be located in areas away from TCE source areas and thus there is no expected issues related to chemical incompatibilities at these locations. A filter pack consisting of No. 2/16 Lonestar sand will be installed in the annulus between the borehole and the well screen from the total depth of the well to approximately 3 to 5 feet above the top of the screened interval. A very fine-grained sand (No. 60) grout filter may be emplaced in the annulus above the top of the filter pack. An approximate 2- to 3-foot thick bentonite seal will be emplaced in the annulus above the filter pack using granular bentonite or bentonite pellets. Sufficient time will be allowed for the bentonite to hydrate prior to grouting the remaining annulus. The annulus between the borehole and well casing will be grouted from the top of the bentonite seal to approximately 2 to 3 feet bls using bentonite grout. The bentonite grout will be tremied down the annular space between the hollow auger and the casing to ensure a competent surface seal. If the annulus is dry, the hollow stem augers may serve as the tremie pipe. Each well will be completed with a locking cap installed inside a traffic-rated subsurface utility vault or monument cover, depending on the monitor well location, unless regulatory requirements or site conditions warrant alternate completion.

#### 6.1.3.4 Bellflower Sand and Gage Aquifer Monitor Wells

Bellflower sand and Gage aquifer monitor wells will be drilled using sonic drilling methods. A lithologic log will be prepared based on the core material obtained from the sonic drill rig. Preliminary well construction specifications for the proposed Bellflower sand and Gage monitor wells are provided (Table A-4).

Monitor wells will be constructed with 2-inch ID schedule 40 PVC blank well casing and 20 feet of 0.020- to 0.040-inch factory slotted PVC well screen, depending on the lithology encountered. The well screen will be placed in the upper portion of the Bellflower sand or Gage aquifer to ensure that VOCs that may migrate through the overlying aquitard will be detected. Due to anticipated lower concentrations of TCE in the proposed monitor wells, PVC well screens are proposed. The proposed monitor wells will be located in areas away from TCE source areas and thus there are no issues related to chemical incompatibilities at these locations. Monitor



well casing will be fitted with stainless steel centralizers above and below the screened interval and at 40-foot intervals along blank casing. A filter pack consisting of Lonestar sand no finer than Lonestar No. 2/16 for 0.020-inch well screen, or no finer than Lonestar No. 3 for 0.040-inch well screen will be installed in the annulus between the borehole and the well screen from the total depth of the well to approximately 3 to 5 feet above the top of the screened interval. A very fine-grained sand (No. 60) grout filter may be emplaced in the annulus above the top of the filter pack. An approximate 2- to 3-foot thick bentonite seal will be emplaced in the annulus above the filter pack using granular bentonite or bentonite pellets. Sufficient time will be allowed for the bentonite to hydrate prior to grouting the remaining annulus. The annulus between the borehole/conductor casing and well casing will be grouted from the top of the bentonite seal to approximately 2 to 3 feet bls using bentonite grout. The bentonite grout will be tremied down the annular space of the borehole to ensure a competent annular seal. The well will be completed with a locking steel casing installed inside a steel and concrete utility vault or monument cover, depending on the monitor well location, unless regulatory requirements or site conditions warrant alternate completion.

#### 6.1.4 Equipment Decontamination

All downhole drilling equipment will be steam cleaned prior to commencing drilling operations, and between drilling locations. All rinse waters will be stored and will be properly disposed.

All materials generated during drilling activities will be contained, labeled, and temporarily stored at the property in 55-gallon drums, roll-off bins, and/or Baker-type portable tanks until an appropriate disposal option is determined. This includes all drill cuttings, and wash and rinse water. SOPs for handling, storage, characterization, and disposal of investigation-generated waste have been prepared and are detailed in Section 6.5.

#### 6.1.5 Documentation

A log of conditions encountered during drilling will be maintained by an experienced hydrogeologist. The log will include lithologic and hydrogeologic descriptions, as well as notations on drilling characteristics and conditions encountered during drilling. Field lithologic descriptions will be based on examination of undisturbed core samples. All logging will be supervised by a





California Registered Geologist. Documentation will be compiled for each boring and will include the following:

- Lithologic log of drill cutting and core samples in a field notebook. Lithologic descriptions for soil will follow the USCS procedures (ASTM, 1984). A project-specific lithologic log form has been developed (Table A-5). In addition to lithologic data, the lithologic log form includes:
  - Project name;
  - Date(s);
  - Boring identifier;
  - Boring location;
  - Geologist's name;
  - Drilling company's name;
  - Drill rig operator's name;
  - Drilling method;
  - Weather conditions; and
  - Space for remarks and comments.
- Field notes compiled by the on-site hydrogeologist during drilling operations.
- Photographs, if available.

Final logs will be prepared based on all available information including core samples and drill cuttings. A copy of the field notebook entries for monitor well borings will be maintained in the field for reference purposes. One set of the completed documentation forms will also be maintained in the field for reference purposes. The original set of notes and forms will be filed in the project files. Drill cutting samples and core samples will be retained until the lithologic log is finalized.

A well completion report will be compiled for each monitor well. The completion report will include the following:

- Well completion report for monitor wells and lithologic log form (Tables A-5 and A-6).
- Schematic well construction diagram illustrating as-built well construction details (Figure A-4).

#### 6.1.6 Quality Assurance

Quality assurance during drilling, sampling, and logging of boreholes and during monitor well construction activities will be accomplished by following this SOP. In addition, the Project Manager will review all drilling documentation, including field notes, well completion forms and lithologic logs throughout drilling operations to ensure conformity with this SOP.

### 6.2 MONITOR WELL DEVELOPMENT

Monitor wells will be developed using a combination of conventional surging, bailing, swabbing, and pumping technologies, or using an alternative method approved by the project manager in consultation with U.S. Environmental Protection Agency. Monitor well development will be conducted under the supervision of a California Registered Geologist.

SOPs for monitor well development are detailed in the following sections.

#### 6.2.1 Equipment and/or Instrumentation

A well development rig will be used to conduct well development. Wells will be developed, as appropriate, using vented surge blocks, bailing, or pumping until the discharge water is clear and sand-free to the extent practicable.

Turbidity will be monitored using a turbidity meter during well development. In addition, the parameters temperature, pH and electrical conductivity (EC) will be measured during development using a field thermometer, pH meter, and EC meter, respectively.



### 6.2.2 Preparation

A qualified drilling contractor will be selected to develop monitor wells. A qualified contractor will have appropriate equipment capabilities, a California C-57 license, experience on similar projects, and documentation of health and safety training. This experience requirement shall apply both to the individual in the field and to the drilling company as a whole.

Prior to entering the field, authorized personnel will contact property owners and applicable agencies to obtain and comply with regulatory requirements regarding access, if required.

The following procedures will be performed in preparation for development of monitor wells:

- Identify the well(s) to be developed;
- Identify the established measuring point for each well;
- Measure the depth to water from the measuring point elevation for each well;
- Measure the total depth of casing of each well; and
- Record the depth to water, well depth, hardness of the bottom of the well, date, and time of measurement on a field observation sheet.

### 6.2.3 Standard Operating Procedures

The following detailed procedures will be used to develop monitor wells.

Monitor wells will be developed within approximately 2 weeks of well completion. Monitor wells will first be bailed to remove sand and fines that may have accumulated in the bottom of the well. Monitor wells will then be surged and pumped until the discharge is clear and sand-free. Water quality parameters including temperature, pH, EC, and turbidity will be monitored. These parameters will not be used as performance criteria. Calibration forms for EC and pH meters are included in Tables A-10 and A-11. Development pumping of monitor wells will be conducted for a



period of two to four hours or until turbidity is reduced to 5 Nephelometric Turbidity Unit (NTUs), whichever occurs first. Development procedures may be modified due to conditions encountered at the site.

The total volume of water purged, water quality parameters measured, sand content, water levels, and the development methods used will be recorded in the field notebook.

#### 6.2.4 Equipment Decontamination

All downhole equipment will be steam cleaned and maintained in a clean condition prior to commencing development operations at each well location. Water generated during decontamination procedures will be handled as detailed in Section 6.5 of this FSP.

#### 6.2.5 Documentation

A development report will be compiled for each monitor well. The development report will include the following:

- Well development report form for monitor wells (Table A-6).
- Field notes compiled by the on-site hydrogeologist during development operations.

#### 6.2.6 Quality Assurance

Quality assurance during monitor well development activities will be accomplished by following this SOP. In addition, the Project Manager will review all field notes and well completion and development forms to ensure conformity with this SOP.



### 6.3 WATER LEVEL MEASUREMENT

Water levels will be measured using calibrated two-wire electric water level sounders. Depth to water will be measured from surveyed reference points. Water level elevations will be calculated as the difference between the surveyed reference point elevation and the depth to water for each well. Water level data will be recorded on preprinted water level data sheets. Water level measuring equipment will be decontaminated between measuring of wells.

Standard operating procedures for water level monitoring are detailed in the following sections.

#### 6.3.1 Equipment and/or Instrumentation

If at all possible, a flat tape sounder will be used to measure water levels. The QED® or Solinst® flat tape sounder is equipped with a plastic, laminated, two-wire cable with a weighted electrode attached to the end of the cable. The cable is graduated in markings every 0.01 foot or 0.02 foot, depending on the model.

If required for access, an electrical sounder equipped with a narrower probe may be used for water level measurement. Sounders manufactured by Fisher or Slope Indicator Company may be used at wells with small sounding ports. These sounders function in a similar manner to flat-tape sounders, although some types require a measuring tape to interpolate between 10-foot or 1-foot gradations printed on the wire.

In the event that floating fuel product is observed in a well, product levels and water levels will be measured using a Keck or similar interface probe. Interface probes function in a similar manner to flat-tape sounders, but use a two-tone signal to indicate whether the probe has encountered water or light nonaqueous phase liquid (LNAPL).



### 6.3.2 Preparation

Water level sounders, including QED® or Solinst® flat tape sounders, will be calibrated on-site at the beginning of each water level round by comparing a water level measured with the sounder against a water level measured with a steel tape or other water level sounder (Table A-7). Additionally, the first ten feet of the sounder will be verified using a steel measuring tape.

The following procedures will be performed in preparation for measuring water levels in wells:

- Identify the wells to be measured;
- Identify the established measuring point for each well. Measuring point elevations for existing wells were determined by a licensed land surveyor. If new wells are installed at the Site, measuring point elevations will be determined by a licensed surveyor. The same measuring point should be used for all water level measurements at each well;
- Review the amount of water level change from the previous water level measurements for each well; and
- Decontaminate the water level sounder by using a nonphosphate detergent wash, followed by a tap water rinse and a distilled water rinse.

### 6.3.3 Standard Operating Procedures

The following detailed procedures will be used for measuring water levels in wells:

- Measure the depth to water from the measuring point elevation twice for each well. The variation between the two consecutive measurements must be no more than 0.02 foot.
- For the QED®, Solinst® or Slope Indicator® sounder, mark the water level and read the measurement from the marking on the flat tape or sounder wire.



- For the Fisher® sounder, measure the distance from the held mark at the measuring point to the nearest footage mark on the electrical sounder wire using a steel tape graduated in hundredths of feet.
- For the Keck or similar interface probe, measure both the depth to LNAPL and the depth to water from the measuring point elevation twice for each well. The variation between the two consecutive measurements must be no more than 0.02 foot. Mark the LNAPL level and water level and read the measurement from the marking on the interface probe.
- Record the depth to water, the depth to LNAPL, if present, date, and time of measurement on the static water level data sheet (Table A-8). Examine previously measured water levels for the well, if available. If the difference between the current water level measurement and the previous water level measurement is greater than approximately 2.0 feet, recheck the current measurement. The field personnel will indicate the method(s) of water level measurement and any rechecked water levels on the water level measurement form.
- Remove water level measurement equipment and decontaminate according to procedures outlined below.
- Upon completion of a water level measurement, the water level data should be compared to the previous water level data, if available, to evaluate the potential for any anomalies. For wells with anomalous results, for example a well that does not follow the seasonal trend, the well must be remeasured. The remeasured water level must be entered into the field notebook.

#### 6.3.4 Equipment Decontamination

Water level sounders will be decontaminated between monitor wells to be sampled during the monitoring round by using a nonphosphate detergent wash, followed by a tap water rinse and a final distilled water rinse. Water level sounders will be decontaminated between monitor wells not sampled during the monitoring round by using a distilled water rinse. Interface probes will be decontaminated between monitor wells regardless of their sampling schedule using a nonphosphate detergent wash, followed by a tap water rinse and a final distilled water rinse.

#### 6.3.5 Documentation

All water level measurements will be recorded on a static water level data sheet (Table A-8). The static water level data sheet includes the following information:

- Well identifier;
- Date;
- Time;
- Method of measurement;
- Sounder identifier;
- Depth to water from the reference point in the nearest 0.01 foot;
- Reference point elevation, if available;
- Previous depth to water in feet;
- Change in water level between the current sampling round and the previous round;
- Comments; and
- Initials of the sampling team.

Calibration of the water level sounders will be documented on a separate form (Table A-7). The water level calibration form includes the following information:

- Date;
- Time;
- Water level sounder type;



- Water level sounder number;
- Calibration method;
- Initials of the person performing the calibration; and
- Remarks.

For monitor wells where floating product is observed, equivalent water levels will be calculated based on the measured thickness and estimated specific gravity of the free product in each of these wells using the following formula:

$$E_{wt} = E_{pw} + (T_p * G_p)$$

Where  $E_{wt}$  is the equivalent water table elevation in feet msl,  $E_{pw}$  is the elevation of the product-water interface in feet msl,  $T_p$  is the thickness of floating product in feet, and  $G_p$  is the specific gravity of the floating product.

#### 6.3.6 Quality Assurance

Quality assurance (QA) of water level measurement data will be accomplished by following the procedures described in this SOP (Table A-9). Calibration information will be entered onto a calibration form. In addition, the following QA procedures for water level measurements will be implemented:

- Measure water levels with a calibrated water level sounder.
- At each location and/or time interval, measure water levels a minimum of two times during routine water level measurement activities. Measure water levels until two consecutive measurements are obtained that have a difference of less than 0.02 foot. Record the measurement on the static water level data sheet (Table A-8). Measure and record water levels to the nearest 0.01 foot.
- Compare measurement data to previous measurements obtained at each well. For variations from previous measurements greater than 2.0 feet or for data that cannot be

explained by observed trends at the Site, repeat the measurements. If possible, use an alternative instrument to verify the accuracy of the data. Indicate the method(s) of water level measurement, the water level sounder serial number, and any rechecked water levels in the comments section on the static water level data sheet (Table A-8).

#### 6.4 GROUNDWATER SAMPLE COLLECTION

The following section describes methods and procedures for collecting groundwater samples from monitor wells at and in the vicinity of the Site.

Representative groundwater samples will be collected from monitor wells for chemical analysis. At a minimum, the field parameters temperature, pH, and EC of the purge water will be measured to ensure that they have stabilized prior to sampling. In addition, dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity may be measured in the field and recorded in the field notebook. Methods and procedures for collecting groundwater samples are detailed in the following sections.

##### 6.4.1 Equipment and/or Instrumentation

Well purging equipment for the newly installed monitor wells will consist of nondedicated stainless steel Grundfos® Redi-Flo 2 electric submersible pumps with dedicated tubing, dedicated electrical submersible pumps, air lift pumps, or bladder pumps depending on equipment installed in each well. Groundwater samples will be collected through dedicated discharge tubing of the non-dedicated Grundfos® Redi-Flo 2 pumps or dedicated electrical submersible or bladder pumps. The Grundfos® Redi-Flo 2 environmental pump is constructed of stainless steel and teflon components and is capable of discharging at variable rates of up to approximately 7 gallons per minute. Purge pumps will be set to a depth just above the top of the screened interval. A variable speed controller will be used to reduce the discharge rate prior to collecting samples. Groundwater samples from the Grundfos® Redi-Flo 2 pump will be collected at a flowrate of approximately 0.03 gallons per minute.



Purge water samples will be directed to a flow-through cell for real time measurement of field parameters. Field equipment consists of a conductivity meter to measure EC, a pH meter to measure pH, and a field thermometer to measure temperature. If applicable, DO will be measured by a DO meter, ORP will be measured by an ORP meter, and turbidity will be measured by a turbidity meter. Some of these measurements are available as functions of an integrated instrument or "multi-meter".

The types and volumes of sample containers used for groundwater sampling have been summarized (Table A-2).

#### 6.4.2 Preparation

Prior to commencing with a sampling event, the following information will be determined and reviewed with all field personnel:

- Objective of the monitoring event;
- Analytical schedule;
- Water quality parameters to be measured;
- Required frequency of measurement;
- Laboratory selected for sample analysis;
- Appropriate methodologies to accomplish objective; and
- Quality control (QC) samples required accomplishing the objective.

The following procedures will be used during preparation for groundwater sample collection:

- Review project objectives; sampling location; sampling procedures; preservation; special handling requirements; packaging; shipping; analytical parameters and detection limits; and sampling schedule with all personnel;
- Review the health and safety procedures with field personnel;
- Follow site access procedures, if applicable;



- Inform the laboratory of expected sample shipment;
- Obtain the appropriate sample bottles from the laboratory;
- Obtain from the laboratory trip blank water vials containing organic-free water for VOC analyses at a rate of two vials for each ice chest containing samples for VOC analysis. Trip blanks will be prepared by the laboratory using organic-free water. The purpose of the trip blanks is to identify potential contamination associated with container preparation and sample transport; and
- Determine the volume of water to be purged from the well prior to sampling.

#### 6.4.3 Standard Operating Procedures

The following sections provide standard operating procedures for well purging, water quality parameter measurement, and groundwater sample collection during routine groundwater monitoring activities.

##### 6.4.3.1 Detailed Procedures for Well Purging

The following detailed procedures will be used for purging monitor wells prior to the collection of groundwater samples. Consistent with previous sampling events conducted at the Site, the approach taken for purging wells at the Site for routine groundwater monitoring will be the purging of three casing volumes. The use of this purging volume has resulted in parameters being stable at the time of sample collection and has allowed for reproducible samples to be collected.

- Measure depth to water in well to be sampled (Section 6.3).
- Determine the volume of water to be purged from the monitor well. One casing volume is determined by multiplying the volume of water in 1 foot of monitor well



casing by the distance between the bottom of the monitor well and the water level measured in the monitor well.

- For routine groundwater sampling, purge the monitor well until at least three casing volumes have been removed and the field parameter measurements for pH, EC, and temperature have stabilized, provided that the well yields sufficient groundwater to remove three casing volumes within approximately 90 minutes. Detailed procedures for water quality parameter measurement have been provided (Section 6.4.3.2). In the event that a monitor well yield is insufficient, one casing volume will be purged and a sample collected after the well recovers to approximately 80 percent of its static condition or within 2 hours of completing purging. Measure the water quality parameters and determine whether parameters have stabilized in accordance with the procedures outlined in Section 6.4.3.2.
- Record the following information on the field data sheet (Table A-13):
  - Static depth to groundwater;
  - Time that pumping is started;
  - Field parameter measurements for each casing volume;
  - Field parameter measurements at time of sampling;
  - Physical characteristics of the water including color, odor, turbidity, etc.;
  - Total gallons removed at end of purging; and
  - Water level at end of purging.
- Handle purge water as described below (Section 6.5).

#### 6.4.3.2 Detailed Procedures for Water Quality Parameter Measurements

The following detailed procedures will be used in conjunction with routine collection of groundwater samples.



Prior to collecting groundwater samples for laboratory analysis, the water quality parameters EC, pH, and temperature will be measured in water samples at each sampling location using a conductivity meter, a pH meter, and a field thermometer, respectively. In addition, DO, ORP, and turbidity may be measured using the appropriate meters.

The probes on the conductivity meter, thermometer, and pH meter will be thoroughly rinsed with distilled water prior to use at each well. At a minimum, the pH meter will be calibrated in pH 4 and pH 10 buffered solutions prior to commencing field work each day. These pH values are expected to bracket the range of pH in groundwater samples collected from monitor wells at the Site. The conductivity meter will be calibrated prior to commencing field work each day. The conductivity meter will be calibrated using standard calibration solutions selected to bracket the range of conductivity expected in groundwater samples collected from monitor wells at the Site. The manufacturers' instructions for use of the instruments will be followed. The field thermometer will be rinsed with distilled water prior to use at each well. The accuracy of the field thermometer will be determined by checking the measured reading against other thermometers. The DO meter will be calibrated in air prior to commencing field work each day. Calibration of the EC, pH, and DO meters will be documented on separate forms (Tables A-10 through A-12). If a photometer-type turbidity meter is used, it will be calibrated to 0 NTUs and 10 NTUs prior to commencing field work each day, and zeroed to 0 NTUs prior to each reading. Depending on the type of meter used, calibration to the parameters EC, pH, DO, and turbidity can be accomplished automatically using the auto-calibration solution provided by the meter's manufacturer. The ORP meter cannot be calibrated in the field.

Parameters will be measured directly at the well discharge point using a flow-through cell. The parameters EC, pH, and temperature at each sampling location will be measured as follows:

- Rinse the flow-through cell with distilled water prior to use at each well. Direct sample water from the pump discharge through the flow-through cell.
- Immediately submerge the probes and thermometer in the flow-through cell and record measurements after they have stabilized.
- Record all field measurements in the field notebook.



- Repeat this sequence for a minimum of once for each casing volume until the difference in subsequent measurements of EC, pH, and temperature is less than 10 percent.
- Periodic measurements of EC, pH, and temperature for pumped wells will be recorded on the groundwater sampling information form (Table A-13).
- In addition, DO, ORP, and turbidity may be measured using the same procedure as that described above.

QA of water quality parameter measurements will be accomplished by following the procedures described in this SOP and by following the equipment manufacturers' operating instructions (Table A-9). Temperature, pH, and EC will be measured during each groundwater-sampling event. Prior to measuring water quality parameters, field personnel will verify that the instruments are properly calibrated according to procedures specified by the manufacturer. Calibration documentation for each instrument will be maintained for reference purposes (Tables A-10 through A-12). Reference solutions for pH and EC will be obtained and used to properly calibrate the instrument. The calibration of the pH meter and conductivity meter will be checked prior to the start of each day.

#### 6.4.3.3 Detailed Procedures for Groundwater Sample Collection

The following detailed procedures will be used for the routine collection of groundwater samples.

- After purging is complete, collect water samples for laboratory analysis.
- Record the following information on the field data sheet:
  - Time of sample collection;
  - Number of containers collected and analyses to be performed;
  - Total gallons purged at time of sampling; and
  - Depth to water at the time of sampling.



- Decrease flow rate from pump.
- Collect water samples in appropriate sample containers from the pump discharge.
- Include one trip blank sample containing organic-free water for VOC analysis to accompany each ice chest shipped each day for these analyses. The trip blanks will be prepared by the primary analytical laboratory, using organic-free water.
- Collect duplicate groundwater samples for VOCs at a rate representing ten percent of the number of original groundwater samples.
- Collect laboratory split groundwater samples for VOCs at a rate representing ten percent of the number of original groundwater samples.
- Prepare split samples for EPA or other agencies during groundwater sampling, if required, by alternately filling agency and H+A sample containers in sequential order for each parameter until all containers are filled.
- Handle QA water samples in a manner identical to other water samples.
- Attach labels to sample containers immediately after samples are collected. Affix custody seals to the seal each sample container following collection of samples.
- Record all pertinent data concerning each sample on the groundwater sampling information field data form (Table A-13).
- Record all pertinent data concerning blank samples on the appropriate field data log form (Table A-14).
- Record all pertinent data concerning duplicate samples on the appropriate field data log form (Table A-15).





- Record all pertinent data concerning laboratory split samples on the appropriate field data log form (Table A-16).
- Complete chain-of-custody record at each sample location prior to sampling at the next well.
- Finalize chain-of-custody record (Table A-17) at the completion of each sampling day.
- Package, store, and transport the samples to the laboratory at the conclusion of each sampling day. The ice chests used to store samples for transmittal to the laboratory will be sealed closed with filament tape and at least two custody seals will be placed across the contact between the ice chest lid and the ice chest, on sides without hinges. The custody seals will indicate whether any tampering occurred during handling and shipment. Samples will be delivered to the laboratories within approximately 24 hours of sample collection.

#### 6.4.4 Sample Containers, Preservation, and Transmittal

A list of the types and volumes of sample containers used for groundwater sampling has been prepared (Table A-2). The laboratory will prepare the sampling containers for each analysis in accordance with the applicable EPA method.

The primary laboratory designated for analysis of groundwater samples is Del Mar Analytical. The designated split laboratory is West Coast Analytical Services, Inc., Santa Fe Springs, California.

Upon collection, all samples will be sealed with custody seals, labeled, and stored on ice in ice chests until received by the laboratory. Sample shipments will contain completed chain-of-custody records stored in resealable plastic bags for shipment to the laboratory (Table A-17). Each ice chest containing samples will be clearly labeled and sealed to prevent tampering.

#### 6.4.5 Equipment Decontamination

Groundwater samples will be collected from monitor wells using nondedicated pumps with dedicated tubing. Groundwater sampling using dedicated pumps will not require equipment decontamination. Non-dedicated pumps used for well purging will be decontaminated.

Non-dedicated sampling equipment will be decontaminated between monitor wells to be sampled during the monitoring round by using a non-phosphate detergent wash, followed by a tap water rinse and a final distilled water rinse. Water generated during decontamination procedures will be containerized and stored in an on-property storage tank.

#### 6.4.6 Documentation

Documentation required for groundwater sample collection includes field data forms, sample labels, custody seals, and chain-of-custody records.

A record of sample identification numbers will be maintained on standardized field data forms (Tables A-17 and A-18). Additional field data include a record of significant events, observations, measurements, personnel, site conditions, sampling procedures, measurement procedures, and calibration records.

All field data entries in the field notebook will be signed, dated, and kept as a permanent record. Erroneous entries will be corrected by crossing a line through the error and entering the correct information. Corrections will be initialed by field personnel making the re-entry.

Sample identification documents will be prepared so that sample identification and chain of custody are maintained and sample disposition is controlled. The following sample identification documents are to be used:

- Sample identification labels (Table A-18); and
- Chain-of-custody records (Table A-17).



Standard sample identification labels and chain-of-custody records will be used to record all information. Sample documentation forms and labels will be completed with waterproof ink. The sample documentation forms will accompany the samples to the laboratory. Copies of the sample documentation forms will be retained by the samplers and sent directly to the Project Manager.

Preprinted adhesive sample labels will be secured to the sample containers by field personnel. The following information will be recorded on the sample label:

- Sample location/identifier;
- Depth at which sample was collected, if applicable;
- Date and time sample was collected;
- Analyses to be performed;
- Preservation instructions;
- Project number;
- Sampler's initials;
- Any other pertinent information; and
- Any special instructions to laboratory personnel.

Official custody of samples will be maintained and documented from the time of sample collection until the validation of analytical results. The chain-of-custody record is the document that records the transfer of sample custody. The chain-of-custody record also serves to cross-reference the sample identifier assigned with the sample identifier assigned by the laboratory. The chain-of-custody record includes the following information:

- Sample location/identifier;
- Project number;
- Sampling date;
- Sampling personnel;
- Shipping method;
- Sample description;
- Sample volume;
- Number of containers;



- Sample destination;
- Preservatives used;
- Analyses to be performed;
- Special handling and reporting procedures; and
- The identity of personnel relinquishing and accepting custody of the samples.

The sampling personnel will be responsible for the samples and will sign the chain-of-custody record to document sample transferal or transport. Samples will be packaged in sealed containers for transport and dispatched to the appropriate laboratory for analysis with a separate chain-of-custody record and sample transmittal letter accompanying each shipment. During transport, samples will be accompanied by the chain-of-custody record and sample transmittal letter.

Once received at the laboratory, laboratory custody procedures apply. It is the laboratory's responsibility to acknowledge receipt of samples and verify that the containers have not been opened or damaged. It is also the laboratory's responsibility to maintain custody and sample tracking records throughout sample preparation and analysis. A copy of the chain-of-custody record is then sent to the Project Manager.

#### 6.4.7 Quality Assurance

QA for groundwater samples collected during routine groundwater monitoring will be accomplished by following the procedures described in this SOP and by monitoring laboratory QA procedures. In addition, the following field quality control methods will be implemented during sample collection:

- Include one trip blank sample containing organic-free water for VOC analyses to accompany each ice chest shipped each day for these analyses. The trip blanks will be prepared by the analytical laboratory using organic-free water. The purpose of the trip blank is to identify possible contamination associated with container preparation and sample transport.



- Collect duplicate groundwater samples at a rate representing ten percent of the number of original groundwater samples for VOC analyses.
- Collect laboratory split groundwater samples at a rate representing ten percent of the number of original groundwater samples for VOC analyses.
- Prepare split samples for EPA or other agencies during groundwater sampling, if required, by alternately filling agency and H+A sample containers in sequential order for each parameter until all containers are filled.
- Identify blank samples in the same manner as all other samples. Identifiers will be determined prior to the sampling round and will be indicated to field sampling personnel prior to the start of sampling activities.
- Additional QA/QC samples, including field blanks and/or equipment rinsate blanks, may be collected at the discretion of the Project Manager.

Prior to the start of a sampling round, the Project Manager will determine the sampling locations for split sample collection, field blank preparation, and duplicate sample collection, if required. Additionally, the Project Manager will specify labeling procedures for these samples. This information will be contained in the field notebooks issued to field sampling personnel prior to the start of sampling activities.

#### 6.5 HANDLING, STORAGE, CHARACTERIZATION, AND DISPOSAL OF INVESTIGATION- DERIVED WASTES

SOPs have been developed for the handling, storage, characterization, and disposal of wastes generated during field work activities. Investigation-derived wastes (IDW) will consist of soil cuttings, personal protective equipment (PPE), decontamination and well purge water, and general trash.

#### 6.5.1 Water

Water will be generated during decontamination, groundwater sampling, and well development activities. Water generated during well development and groundwater sampling will be contained at the wellhead in drums or a water trailer and transferred to the wastewater storage tanks. Large capacity aboveground wastewater storage tanks at the property will be used to contain water generated during this investigation.

A central staging area for decontamination of drilling and sampling equipment will be established at the Property. Water generated during decontamination procedures will be containerized and transferred to the wastewater storage tanks.

Decontamination and well purge water will be stored separately in Baker tanks or Department of Transportation (DOT) 17H 55-gallon drums. Each container will be clearly marked to indicate the waste source and contents. Prior to disposal or shipment offsite, the waste disposal contractor will label containers with appropriate DOT identification and classification information.

The waste disposal contractor will use data generated during initial sampling of the wells to determine the appropriate disposal of the purge and decontamination water. If necessary, the waste disposal contractor or H+A field staff will sample the tanks in order to obtain the necessary data for waste profiling. After reviewing the results of the waste profiling, disposal will be arranged.

#### 6.5.2 Soil

Drill cuttings will be generated during monitor well drilling. Drill cuttings will be stored in 55-gallon drums or roll off bins at each well location. The drums and roll-off bins will be moved to the property once drilling at the monitor well is completed. Each container will be clearly labeled with the monitor well identifier, date, and depth interval for drill cuttings contained therein.

### 6.5.3 Characterization

Waste characterization by the waste handling contractor may include sample collection and laboratory analysis of drill cuttings generated during field activities. Characterization of drill cuttings will be required to determine appropriate waste disposal. Drill cutting samples will be analyzed for VOCs, DDT, and pCBA.

### 6.5.4 Disposal

Drill cuttings generated during drilling and well installation activities will be stored in storage containers pending evaluation of disposal options. Montrose will be responsible for disposal of all wastes generated during field activities.

Water generated during decontamination procedures will be containerized and stored at the Property. Spent health and safety equipment will be containerized and stored at the Property. Purge water from monitor wells will be contained at the wellhead and transported to a storage tank at the Property. Purge water and decontamination water will be sent off-site for treatment. All waste will be disposed at an EPA-approved waste disposal facility. Wastes classified as hazardous waste will be disposed of offsite by the waste disposal subcontractor within 90 days of collection. The waste disposal subcontractor will provide services including, but not limited to, sampling and profiling, handling and manifesting, and transportation and disposal of wastes. The waste disposal contractor or H+A field staff will collect waste samples for analysis and waste profiling as soon as practicable. After reviewing the results of the profiling, disposal will be arranged.

Used PPE and other disposal equipment used at locations where Level D site safety protocols are required will be bagged and characterized as non-hazardous and disposed of in industrial trash dumpsters. Heavily soiled PPE will be bagged and stored separately pending review of the analytical results from sampling. If the analytical results indicate that the wastes generated at the site were hazardous, the heavily soiled PPE will be characterized and disposed of as hazardous waste. Used PPE worn at locations requiring a higher level of personal protection than Level D will be characterized as hazardous waste. No sampling or analysis of this PPE will be performed.

## 7.0 HEALTH AND SAFETY

All on-site field work will be conducted in accordance with the Site-specific Health and Safety Plan (H+A, 2003). The Site-specific Health and Safety Plan will be included in the field version of the FSP. A hospital route map has been prepared (Figure A-5).

On-site field personnel will have 40-Hour Hazardous Waste Operations and Emergency Response training and current 8-Hour Refresher Training in accordance with 29 CFR 1910.120. Field personnel will also have certification of current respirator fit-testing and first aid training.





TABLE A-1

## DATA USES AND LIMITATIONS

PARAMETER	USES	LIMITATIONS
Water Level Measurements	<ul style="list-style-type: none"><li>• Preparation of water level elevation contour maps.</li><li>• Determination of direction of groundwater flow.</li><li>• Determination of horizontal and vertical hydraulic gradients.</li><li>• Tracking of water levels over time at discrete point in the hydrostratigraphic unit (hydrograph).</li><li>• Tracking changes in water table and effect on saturated thickness.</li><li>• Calculation of volume of groundwater required for purging prior to groundwater sampling.</li></ul>	<ul style="list-style-type: none"><li>• Precision of water level measurement is 0.01 foot.</li><li>• Measured water level only representative of hydrostratigraphic unit screened at time of measurement.</li><li>• Preparation of contour maps requires that water level elevations be interpolated between measurement locations.</li></ul>
Groundwater Samples	<ul style="list-style-type: none"><li>• Monitor concentrations of analyzed compounds dissolved in groundwater.</li><li>• Preparation of compound concentration contour maps.</li><li>• Tracking of groundwater quality over time at discrete point in the hydrostratigraphic unit (hydrograph).</li></ul>	<ul style="list-style-type: none"><li>• Precision of each analysis varies by compound, analytical method, and laboratory capabilities.</li><li>• Each analytical result only representative of location of well, hydrostratigraphic unit, and time of sampling.</li><li>• Preparation of contour maps requires that groundwater concentrations be interpolated between sample collection locations.</li></ul>



TABLE A-1  
DATA USES AND LIMITATIONS

PARAMETER	USES	LIMITATIONS
Lithology	<ul style="list-style-type: none"><li>• Preparation of lithologic logs</li><li>• Preparation of cross sections</li><li>• Evaluate change in thickness of geologic units</li></ul>	<ul style="list-style-type: none"><li>• Precision of depth measurements is approximately 1 foot</li><li>• Core loss will require extrapolation between adjacent samples with recovery</li><li>• Preparation of cross section requires geologic unit depths be interpolated between wells.</li></ul>

**TABLE A-2**  
**HANDLING PROTOCOL FOR GROUNDWATER SAMPLES**

ANALYTE	EPA METHOD	SAMPLE CONTAINER	OTHER REQUIREMENTS	PRESERVATION METHOD	MAXIMUM HOLDING TIME
<u>VOLATILE ORGANIC COMPOUNDS</u>	8260B	2 X 40 ml VOA VIAL, TEFLON LINED SEPTUM	VIALS FILLED COMPLETELY, NO HEAD SPACE	HCl, COOL TO 4°C	14 DAYS
<u>DDT, BHC, and Other Organochlorine Pesticides</u>	8081A	1 X 1 LITER AMBER GLASS BOTTLE	BOTTLE FILLED TO NECK	UNPRESERVED, COOL TO 4°C	7 DAYS TO EXTRACT 40 DAYS TO ANALYZE
<u>PARACHLOROBENZENE SULFONIC ACID (pCBSA)</u>	Modified 314.0	1 X 500 ML PLASTIC	BOTTLE FILLED TO NECK	UNPRESERVED, COOL TO 4°C	28 DAYS
<u>GENERAL MINERALS</u>		1 X 1 LITER PLASTIC	BOTTLE FILLED TO NECK	UNPRESERVED, COOL TO 4°C	
Aluminum	6010B				6 MONTHS
Alkalinity	SM 2320B				14 DAYS
Calcium	6010B				6 MONTHS
Chloride	300.0				28 DAYS
Potassium	6010B				6 MONTHS
Iron	6020B				6 MONTHS
Magnesium	6010B				6 MONTHS
Manganese	6010B				6 MONTHS
Nitrate	300.0				48 HOURS
Sodium	6010B				6 MONTHS
Sulfate	300.0				28 DAYS
Specific Conductance	120.1				28 DAYS
Total Dissolved Solids	160.1				7 DAYS
Hardness	SM 2340B	1 X 500 ML PLASTIC	BOTTLE FILLED TO NECK	HNO <sub>3</sub> TO Ph <2, COOL TO 4°C	6 MONTHS
<u>CALIFORNIA TITLE 22 METALS (CCR 17 METALS)</u>		1 X 1 LITER PLASTIC	BOTTLE FILLED TO NECK	FILTER, HNO <sub>3</sub> TO Ph <2, COOL TO 4°C	6 MONTHS
Antimony	6020B				
Arsenic	6020B				
Barium	6020B				
Beryllium	6020B				
Cadmium	6020B				
Chromium	6020B				
Cobalt	6020B				
Copper	6020B				
Lead	6020B				
Molybdenum	6020B				
Mercury	7470A				
Nickel	6020B				
Selenium	6020B				
Silver	6020B				
Thallium	6020B				
Vanadium	6020B				
Zinc	6020B				

*If not filtered in field, do not place in acidified sample bottle and instruct lab to filter and acidify upon receipt.*

28 DAYS

TABLE A-2

HANDLING PROTOCOL FOR GROUNDWATER SAMPLES

FOOTNOTES

(<) = Less than  
DDT = Dichlorodiphenyltrichloroethane  
BHC = Hexachlorocyclohexane

\*C = degrees Celsius  
EPA = U.S. Environmental Protection Agency  
HCl = Hydrochloric Acid

lab = Laboratory  
ML = Milliliter  
VOA = Volatile Organic Analysis

NA = Not Applicable  
HNO<sub>3</sub> = Nitric Acid

TABLE A-3

WELL CONSTRUCTION DATA FOR EXISTING WELLS

WELL IDENTIFIER	DATE DRILLED	DEPTH OF WELL (ft bls)	WELL DIAMETER (inches)	PERFORATED INTERVAL (ft bls)
UBE-1	04/02/91	94.3	8	60.7 - 90.7
UBI-1	02/08/04	91.7	6	43.7 - 88.7
UBI-2	02/10/04	92.5	6	44.5 - 89.5
UBT-1	09/22/89	99	6	60 - 91
UBT-2	09/16/89	99	4	50 - 91
UBT-3	09/12/89	99	4	60 - 91
MW-1	04/26/85	76.6	4	63 - 73
MW-2	04/27/85	77.5	4	66.7 - 76.7
MW-3	04/26/85	75	4	64.4 - 74.4
MW-4	04/26/85	75.3	4	64.9 - 74.9
MW-5	04/25/85	72.4	4	61.5 - 72.5
MW-6	11/17/88	85	4	65 - 80
MW-7	11/18/88	85	4	65 - 80
MW-8	05/10/89	85	4	65 - 80
MW-9	05/09/89	85	4	66 - 81
MW-10	11/22/88	83	4	62 - 77
MW-11	11/23/88	84	4	62 - 77
MW-12	11/19/88	85	4	61 - 76
MW-13	11/15/88	81	4	62 - 77
MW-14	11/21/88	80	4	58 - 73
MW-16	03/31/90	78	4	59 - 76
MW-17	04/02/90	83	4	65 - 81
MW-19	03/30/90	80	4	63 - 79
MW-20	04/04/90	74	2	57 - 73
MW-21	03/28/90	73	4	54 - 70
MW-22	04/01/90	74	4	57 - 73
MW-23	08/03/89	80	4	60 - 75
MW-24	08/04/89	68	4	49 - 64
MW-25	08/05/89	75	4	56 - 71
MW-26	08/06/89	80	4	59 - 74
MW-27	09/19/91	77	4	59 - 75
MW-28	11/16/91	74	4	54 - 71
MW-29	09/18/91	75	4	57 - 73
MW-30	09/20/91	80	4	54 - 70

Note: Refer to page 3 of this table for footnotes.

**TABLE A-3**
**WELL CONSTRUCTION DATA FOR EXISTING WELLS**

WELL IDENTIFIER	DATE DRILLED	DEPTH OF WELL (ft bls)	WELL DIAMETER (inches)	PERFORATED INTERVAL (ft bls)
BF-1	12/11/86	126.5	4	113.5 - 124.0
BF-2	12/09/86	128	4	114.0 - 124.5
BF-3	12/05/86	125.5	4	113.5 - 124.0
BF-4	12/08/86	126	4	112 - 123
BF-5	01/14/89	135	4	122 - 132
BF-6	12/03/88	132	4	115 - 125
BF-7	12/09/88	119	4	106 - 116
BF-9	01/03/89	129	6	107 - 128
BF-10	12/01/89	131	4	120 - 130
BF-11	12/06/89	124	4	104 - 124
BF-12	11/30/89	120	4	110 - 120
BF-13	11/01/89	138	4	117 - 137
BF-14	10/04/89	122	4	111 - 121
BF-15	10/10/89	114	4	98 - 113
BF-16	12/16/89	130	4	103 - 124
BF-17	12/18/89	124	4	100 - 120
BF-19	06/26/91	135	4	128 - 133
BF-20	08/14/91	130	4	110 - 129
BF-21	05/24/91	123	4	96 - 121
BF-22	06/12/91	120	4	87 - 117
BF-23	06/17/91	120	4	101 - 116
BF-24	05/17/91	122	4	96 - 121
BF-25	06/20/91	115	4	94 - 104
BF-26	08/28/91	110	4	90 - 105
BF-27	07/11/91	122	4	101 - 121
BF-28	07/18/91	115	4	95 - 110
BF-29	08/06/91	126	4	100 - 120
BF-30	08/19/91	120	4	82 - 113
BF-31	08/22/91	135	4	105 - 135
BF-32A	12/09/93	120	4	65 - 115
BF-33	09/05/91	101	4	60 - 100
G-1	11/26/86	164.5	4	140.5 - 161.0
G-2	11/16/86	180	4	155.0 - 175.5
G-3	12/01/86	170	4	145.5 - 166.0
G-4	01/17/89	195	4	154 - 194
G-5	12/07/88	194	4	151 - 190
G-6	12/12/88	192	4	149 - 190

Note: Refer to page 3 of this table for footnotes.

TABLE A-3

WELL CONSTRUCTION DATA FOR EXISTING WELLS

WELL IDENTIFIER	DATE DRILLED	DEPTH OF WELL (ft bls)	WELL DIAMETER (inches)	PERFORATED INTERVAL (ft bls)
G-8	12/13/89	181	4	140 - 180
G-9	12/04/89	213	4	171 - 213
G-11	11/04/89	218	4	177 - 217
G-12	10/21/89	198	4	158 - 198
G-13	10/07/89	197	4	157 - 197
G-14	08/30/91	196	4	155 - 195
G-15	08/09/91	184	4	142 - 182
G-16	06/06/91	187	4	145 - 185
G-17	06/29/91	213	4	172 - 212
G-18	05/30/91	202	4	161 - 201
G-19	07/25/91	187	4	145 - 185
LG-1	11/12/86	211	4	188.5 - 209.0
LG-2	12/21/88	207	4	185 - 205
LW-1	08/24/89	251	4	230 - 250
LW-2	08/31/89	253	4	232 - 252
LW-3	11/18/89	261	4	238 - 259
LW-4	09/09/91	246	4	225 - 245
LW-5	09/17/91	251	4	230 - 250
LW-6	09/21/91	256	4	235 - 255
LW-7	09/24/91	251	4	230 - 250

FOOTNOTES

Ft bls = Feet below land surface  
 NM = Not measured

TABLE A-4

WELL CONSTRUCTION DATA  
FOR  
PROPOSED WELLS

WELL IDENTIFIER	TOTAL DEPTH DRILLED (feet bls) (a)	BOREHOLE DIAMETER (inches)	WELL CASING / SCREEN DIAMETER / TYPE (g)	6-INCH STEEL CONDUCTOR CASING INTERVAL (feet bls) (a)	SCREEN INTERVAL (feet bls) (a)	SCREEN SLOT SIZE (inches) (b)	FILTER PACK SIZE (c)	FILTER PACK INTERVAL (feet bls) (a)	FINE SAND SEAL INTERVAL (feet bls) (a,d)	BENTONITE SEAL INTERVAL (feet bls) (a,e)	GROUT SEAL (feet bls) (a,f)
MW-31	0-82	12	4-inch/PVC	NA	65-80	0.020	#2/16	62-82	60-62	57-60	0-57
BF-34	127	10/6 (h)	2-inch/PVC	0-100	105-125	0.020-0.040	#2/16-#3	102-127	100-102	97-100	0-97
BF-35	132	10/6 (h)	2-inch/PVC	0-100	110-130	0.020-0.040	#2/16-#3	107-132	105-107	102-105	0-102
G-20	167	10/6 (h)	2-inch/PVC	0-138	145-165	0.020	#2/16	142-167	140-142	137-140	0-137
G-21	172	10/6 (h)	2-inch/PVC	0-140	150-170	0.020	#2/16	147-172	145-147	142-145	0-142

FOOTNOTES

Ft bls = Feet below land surface.

PVC = Polyvinyl Chloride.

(a) Depths are approximate and will be adjusted in the field based on the lithology encountered.

(b) Screen slot size is approximate and may be adjusted based on the lithology of the screened interval.

(c) Filter pack size is approximate and may be adjusted based on the screen slot size that is selected for the well. Filter pack consists of Monterey sand. Filter pack sizes are Lone Star Lapis Lustre size designations.

(d) #60 silica sand.

(e) Granular bentonite or pellets.

(f) Volclay grout or equivalent.

(g) Schedule 40 PVC.

(h) Conductor casing for Bellflower sand and Gage monitor wells will be installed in a 10-inch diameter borehole and well casing and screen will be installed in a 6-inch diameter borehole.



**TABLE A-5**

# LITHOLOGIC LOG FORM

[illegible]

## FOOTNOTES

DIA = Diameter  
DTW = Depth to water  
ft/bls = Feet below land surface  
ft/bmp = Feet below measuring point  
ft/msl = Feet mean sea level  
USCS = Unified Soil Classification System



TABLE A-6

WELL COMPLETION AND DEVELOPMENT REPORT

Project No. \_\_\_\_\_

Project Name \_\_\_\_\_

COMPLETION REPORT FOR WELL \_\_\_\_\_

Drilling Company: \_\_\_\_\_

Driller: \_\_\_\_\_

Drill Rig: \_\_\_\_\_

Date drilling started: \_\_\_\_\_

Date drilling completed: \_\_\_\_\_

Description of drilling \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

A. GENERAL

Location: \_\_\_\_\_

Location coordinates: x \_\_\_\_\_ y \_\_\_\_\_

Total depth of borehole: \_\_\_\_\_ feet bls

Borehole diameter: \_\_\_\_\_ inches, from \_\_\_\_\_ to \_\_\_\_\_ feet bls

\_\_\_\_\_ inches, from \_\_\_\_\_ to \_\_\_\_\_ feet bls

Lost circulation zones: \_\_\_\_\_

Lithology logged by: \_\_\_\_\_

B. CONSTRUCTION

**Conductor Casing**

Type: \_\_\_\_\_, O.D.: \_\_\_\_\_

Wall thickness: \_\_\_\_\_, from \_\_\_\_\_ to \_\_\_\_\_ feet bls

Centralizers/Shoe: \_\_\_\_\_



TABLE A-6

WELL COMPLETION AND DEVELOPMENT REPORT

Project No. \_\_\_\_\_

Project Name \_\_\_\_\_

COMPLETION REPORT FOR WELL \_\_\_\_\_

**Well Casing**

Type: \_\_\_\_\_, O.D.: \_\_\_\_\_

Wall thickness: \_\_\_\_\_, from \_\_\_\_\_ to \_\_\_\_\_ feet bls

Type: \_\_\_\_\_, O.D.: \_\_\_\_\_

Wall thickness: \_\_\_\_\_, from \_\_\_\_\_ to \_\_\_\_\_ feet bls

**Well Screen**

Type: \_\_\_\_\_, O.D.: \_\_\_\_\_

Wall thickness: \_\_\_\_\_, from \_\_\_\_\_ to \_\_\_\_\_ feet bls

Type: \_\_\_\_\_, O.D.: \_\_\_\_\_

Wall thickness: \_\_\_\_\_, from \_\_\_\_\_ to \_\_\_\_\_ feet bls

Centralizers/Shoe: \_\_\_\_\_

**C. GROUT AND CEMENTING RECORD**

Annular space: \_\_\_\_\_

Type of cement/grout: \_\_\_\_\_

Method of emplacement: \_\_\_\_\_

Approximate number of yards/bag: \_\_\_\_\_

Comments: \_\_\_\_\_

Annular space: \_\_\_\_\_

Type of cement/grout: \_\_\_\_\_

Method of emplacement: \_\_\_\_\_

Approximate number of yards/bag: \_\_\_\_\_

Comments: \_\_\_\_\_

**TABLE A-6**  
**WELL COMPLETION AND DEVELOPMENT REPORT**

Project No. \_\_\_\_\_

Project Name \_\_\_\_\_

**COMPLETION REPORT FOR WELL \_\_\_\_\_**

**D. GRAVEL PACK**

Type: \_\_\_\_\_, from \_\_\_\_\_ to \_\_\_\_\_ feet bls

Volume emplaced: \_\_\_\_\_, Method emplaced: \_\_\_\_\_

Type: \_\_\_\_\_, from \_\_\_\_\_ to \_\_\_\_\_ feet bls

Volume emplaced: \_\_\_\_\_, Method emplaced: \_\_\_\_\_

**Grout Filter**

Type: \_\_\_\_\_, from \_\_\_\_\_ to \_\_\_\_\_ feet bls

Volume emplaced: \_\_\_\_\_, Method emplaced: \_\_\_\_\_

**Bentonite Seal**

Type: \_\_\_\_\_, from \_\_\_\_\_ to \_\_\_\_\_ feet bls

Volume emplaced: \_\_\_\_\_, Method emplaced: \_\_\_\_\_

**E. DEVELOPMENT RECORD**

Date: \_\_\_\_\_

Procedure: \_\_\_\_\_

Duration: \_\_\_\_\_ minutes

Procedure: \_\_\_\_\_

Duration: \_\_\_\_\_ minutes

Pumping duration: \_\_\_\_\_ minutes

Average pump discharge rate: \_\_\_\_\_ gpm

Drawdown at end of pumping: \_\_\_\_\_ feet bls

Field parameters (initial): pH \_\_\_\_\_, Conductivity \_\_\_\_\_ (umhos),

Temperature \_\_\_\_\_ (°C), Turbidity \_\_\_\_\_

Field parameters (final): pH \_\_\_\_\_, Conductivity \_\_\_\_\_ (umhos),

Temperature \_\_\_\_\_ (°C), Turbidity \_\_\_\_\_

**TABLE A-6**  
**WELL COMPLETION AND DEVELOPMENT REPORT**

Project No. \_\_\_\_\_

Project Name \_\_\_\_\_

**COMPLETION REPORT FOR WELL \_\_\_\_\_**

**F. PUMP INSTALLATION DATA**

Pump installer: \_\_\_\_\_

Installation date: \_\_\_\_\_

Pump purpose/type: \_\_\_\_\_

Pump model/specs: \_\_\_\_\_

Pump setting: \_\_\_\_\_

Pump purpose/type: \_\_\_\_\_

Pump model/specs: \_\_\_\_\_

Pump setting: \_\_\_\_\_

Surface completion (hole vault type, etc.): \_\_\_\_\_

**G. REFERENCE ELEVATIONS**

Land surface elevation: \_\_\_\_\_ feet msl

Measuring point elevation: \_\_\_\_\_ feet msl

Description of measuring point: \_\_\_\_\_

Date surveyed: \_\_\_\_\_, by: \_\_\_\_\_

**H. COMMENTS AND NOTES RE DRILLING WELL CONSTRUCTION OPERATIONS**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

TABLE A-6

WELL COMPLETION AND DEVELOPMENT REPORT

Project No. \_\_\_\_\_

Project Name \_\_\_\_\_

MONITOR WELL PLACEMENT FORM

Proposed Well ID: \_\_\_\_\_ Actual Well ID: \_\_\_\_\_

Date: \_\_\_\_\_ By: \_\_\_\_\_

Street Address or APN: \_\_\_\_\_

City/Town: \_\_\_\_\_

Nearest Cross Street: \_\_\_\_\_

Thomas Brothers Reference: \_\_\_\_\_

Owner/Jurisdiction: \_\_\_\_\_

County Permit No. : \_\_\_\_\_

USA Alert Ticket: \_\_\_\_\_

Comments: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Sketch Map

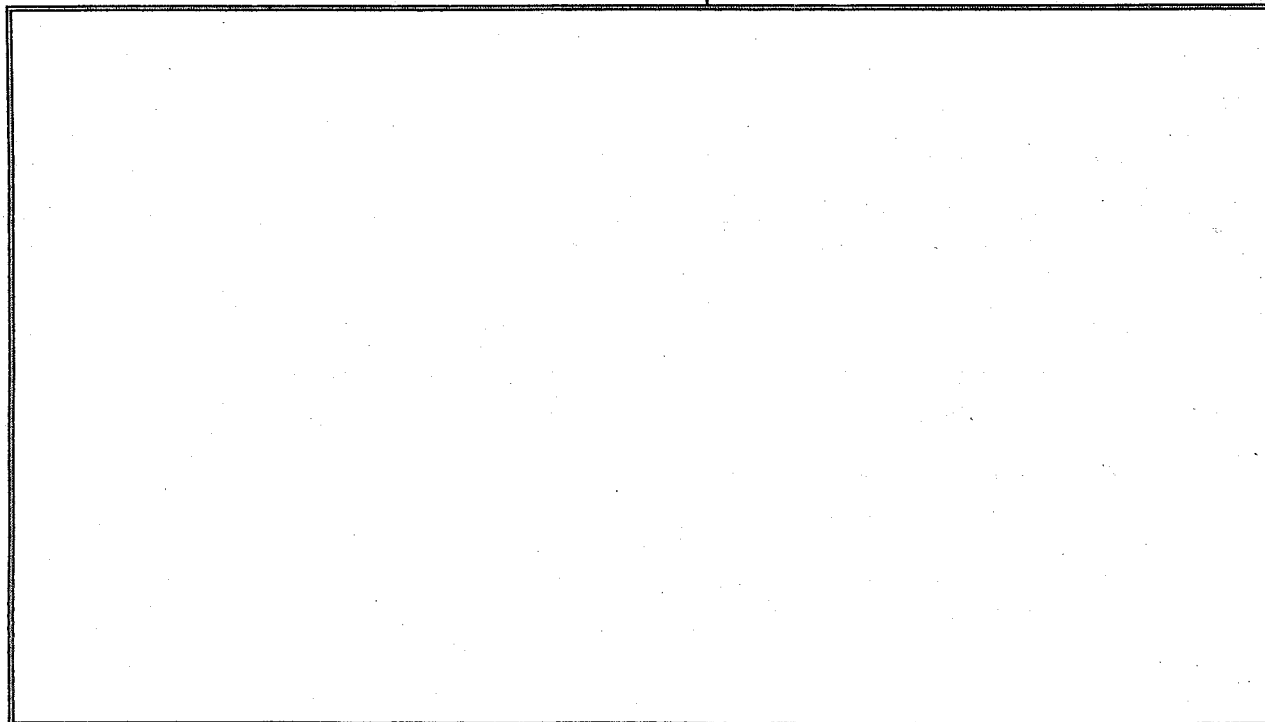




TABLE A-6

WELL COMPLETION AND DEVELOPMENT REPORT

Project No. \_\_\_\_\_

Project Name \_\_\_\_\_

DEVELOPMENT REPORT FOR WELL \_\_\_\_\_

A. DEVELOPMENT REPORT

Well Type: \_\_\_\_\_

Development Company: \_\_\_\_\_

Developer/Helper: \_\_\_\_\_

Development Rig: \_\_\_\_\_

Date of Development: \_\_\_\_\_

H+A Field Notebook: \_\_\_\_\_

H+A Personnel: \_\_\_\_\_

Description of Development: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

B. WELL DEVELOPMENT

Total Well (Driller): \_\_\_\_\_ feet bls

Depth to bottom of well before development: \_\_\_\_\_ feet bls

Bottom: soft, medium, hard

Depth to water before development: \_\_\_\_\_ feet bls

Procedure: \_\_\_\_\_

Duration: \_\_\_\_\_ minutes, Comment: \_\_\_\_\_

Procedure: \_\_\_\_\_

Duration: \_\_\_\_\_ minutes, Comment: \_\_\_\_\_

Procedure: \_\_\_\_\_

Duration: \_\_\_\_\_ minutes, Comment: \_\_\_\_\_

Procedure: \_\_\_\_\_

Duration: \_\_\_\_\_ minutes, Comment: \_\_\_\_\_

**TABLE A-6**  
**WELL COMPLETION AND DEVELOPMENT REPORT**

Project No. \_\_\_\_\_  
Project Name \_\_\_\_\_

**DEVELOPMENT REPORT FOR WELL \_\_\_\_\_**

Procedure: \_\_\_\_\_  
Duration: \_\_\_\_\_ minutes, Comment: \_\_\_\_\_  
Pumping duration: \_\_\_\_\_ minutes  
Field parameters (initial): pH \_\_\_\_\_, Conductivity \_\_\_\_\_ (umhos),  
Temperature \_\_\_\_\_ (°C), Turbidity \_\_\_\_\_  
Average pump discharge rate: \_\_\_\_\_ gpm Gallons purged: \_\_\_\_\_  
Depth to water at end of pumping: \_\_\_\_\_ feet bls, Drawdown \_\_\_\_\_ feet  
Specify Capacity: \_\_\_\_\_ gpm/ft  
Field parameters (final): pH \_\_\_\_\_, Conductivity \_\_\_\_\_ (umhos),  
Temperature \_\_\_\_\_ (°C), Turbidity \_\_\_\_\_  
Depth to bottom of well after development: \_\_\_\_\_ feet bls  
Bottom: soft, medium, hard  
Depth to water after development and recovery: \_\_\_\_\_ feet bls  
Measured: \_\_\_\_\_ hours after final pumping

**C. PUMP INSTALLATION DATA**

Pump installer: \_\_\_\_\_  
Installation date: \_\_\_\_\_  
Pump purpose/type: \_\_\_\_\_  
Pump model/specs: \_\_\_\_\_  
Pump setting: \_\_\_\_\_  
Pump purpose/type: \_\_\_\_\_  
Pump model/specs: \_\_\_\_\_  
Pump setting: \_\_\_\_\_  
Comments: \_\_\_\_\_  
\_\_\_\_\_





TABLE A-6

WELL COMPLETION AND DEVELOPMENT REPORT

Project No. \_\_\_\_\_

Project Name \_\_\_\_\_

DEVELOPMENT REPORT FOR WELL \_\_\_\_\_

D. SURVEY DATA

Surveyor: \_\_\_\_\_

Date surveyed: \_\_\_\_\_

Land surface elevation: \_\_\_\_\_ feet msl

Measuring point elevation: \_\_\_\_\_ feet msl

Location coordinate: x \_\_\_\_\_ y \_\_\_\_\_

Description of measuring point: \_\_\_\_\_

E. COMMENTS

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

FOOTNOTES

°C = degrees Celsius  
bls = Below land surface  
ft = Feet  
gpm = Gallons per minute  
msl = Mean sea level  
O.D. = Outer Diameter  
specs = Specifications  
umhos = Micromhos

# WATER LEVEL INDICATOR CALIBRATION DOCUMENTATION FORM

PROJECT NUMBER: \_\_\_\_\_

[illegible]

TABLE A-8

## STATIC WATER LEVEL DATA SHEET

MONTH/YEAR: \_\_\_\_\_

PROJECT NUMBER: \_\_\_\_\_

METHOD OF MEASUREMENT/SOUNDER IDENTIFIER: \_\_\_\_\_

[illegible]

## FOOTNOTES

msl = Mean sea level  
bls = Below land surface

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01/27/04

TABLE A-9

FIELD PROCEDURES AND QUALITY ASSURANCE OBJECTIVES

PROCEDURE	EQUIPMENT CHECK AND/OR CALIBRATION	OPERATIONAL PROCEDURE	PERSONNEL	DATA STORAGE SYSTEM	PRECISION	ACCURACY
Water Level Measurement	Electric water level sounder, steel tape, interface probe	SOP and manufacturer instructions for equipment	Hydrogeologist, field technician	Hard copy, electronic	0.01 foot	±0.1 foot
Water Sample Collection (excludes determination of electrical conductivity, pH, and temperature)	Depth specific sampling devices, sample bottles, shipping containers, transmittal forms, chain-of-custody records, field forms	SOP	Hydrogeologist, field technician	Hard copy	NA	NA
Electrical Conductivity	Conductivity meter, field form	SOP and manufacturer instructions for equipment	Hydrogeologist, field technician	Hard copy	±5 umhos when scale units are x1	±10 umhos when scale units are x1
Turbidity	Turbidity meter, field form	SOP and manufacturer instructions for equipment	Hydrogeologist, field technician	Hard copy	Based on instrument	Based on instrument
Dissolved Oxygen	Photometric meter, appropriate filters, high and low range ampoules, field form	SOP and manufacturer instructions for equipment	Hydrogeologist, field technician	Hard copy	Based on instrument	Based on instrument
pH	pH meter, field form	SOP and manufacturer instructions for equipment	Hydrogeologist, field technician	Hard copy	±0.05 unit	0.5 unit
Temperature	Field thermometer, field form	SOP and manufacturer instructions for equipment	Hydrogeologist, field technician	Hard copy	±0.1°C	±0.5°C

FOOTNOTES

SOP = Standard Operational Procedure  
NA = Not Applicable

umhos = Micromhos  
°C = Degrees Celsius

## ELECTRICAL CONDUCTIVITY METER CALIBRATION FORM

MONTH/YEAR: \_\_\_\_\_

PAGE \_\_\_\_\_ OF \_\_\_\_\_

[illegible]

umhos/cm = Microhms per centimeter  
°C = Degrees Centigrade

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01/27/04



## pH METER CALIBRATION FORM

PAGE \_\_\_\_\_ OF \_\_\_\_\_

[illegible]

FOOTNOTE

°C = degrees Celsius  
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01/27/04

TABLE A-12

Project \_\_\_\_\_

## INSTRUMENT CALIBRATION LOG FOR GROUNDWATER SAMPLING

## DISSOLVED OXYGEN METER CALIBRATIONS (AIR METHOD)

Page \_\_\_\_ of \_\_\_\_

[illegible]

## FOOTNOTES

- Solubility of oxygen.
- Altitude correction factor.
- Calibration value determined by multiplying solubility value by altitude correction factor.

°C = degrees Celsius  
ft msl = Feet mean sea level  
mg/l = Milligrams per liter

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**TABLE A-13**  
**GROUNDWATER SAMPLING INFORMATION FORM**

WELL ID: \_\_\_\_\_

VOLUME OF WATER IN CASING \_\_\_\_\_ GAL  
3 CASING VOLUMES \_\_\_\_\_ GAL  
MONITOR WELL RECHARGE RATE \_\_\_\_\_ SLOW \_\_\_\_\_ FAST  
PURGE METHOD \_\_\_\_\_ BAILED \_\_\_\_\_ PUMPED

INITIALS: \_\_\_\_\_

..... FIELD PARAMETERS .....							APPROX. GALLONS PURGED	APPROX. CASING VOLUMES PURGED	COMMENTS	BEGIN PURGING @ _____ HRS	
TIME	T° ( )	pH	EC	O.R.P.	D.O.	TURB.				STOP PURGING @ _____ HRS	
										GALLONS PURGED _____	
										CASING VOLS PURGED _____	
										WL _____ FT @ _____ HRS	
										WEATHER CONDITIONS	
										TIME _____ TEMP _____	
										SKIES _____	
										WIND _____ (mph) FROM _____	
										AIR MONITORING PID/FID ppm	
<b>NOTES</b> (Color, odor, sand & silt content, factors possibly affecting samples, condition of vault, wellhead, sampling apparatus, etc.)							VAULT _____ BKGD _____				
							BREATHING ZONE _____				
							DISCHARGE WATER _____				
							HEALTH & SAFETY EQUIPMENT (circle)				
							RESPIRATORS TYVEK GLOVES GOGGLES				

**BOE-C6-0066979**



**TABLE A-14**

# BLANK SAMPLE LOG FORM

PROJECT NUMBER: \_\_\_\_\_

MONTH/YEAR: \_\_\_\_\_

PAGE \_\_\_\_\_ OF \_\_\_\_\_

[illegible]



## TABLE A-15

**DUPLICATE SAMPLE LOG FORM**

PROJECT NUMBER: \_\_\_\_\_

MONTH/YEAR: \_\_\_\_\_

PAGE \_\_\_\_\_ OF \_\_\_\_\_

[illegible]

TABLE A-16

## LABORATORY SPLIT SAMPLE LOG FORM

PROJECT NUMBER: \_\_\_\_\_

MONTH/YEAR: \_\_\_\_\_

PAGE \_\_\_\_\_ OF \_\_\_\_\_

[illegible]

## HARGIS + ASSOCIATES, INC.

DATE.

PA

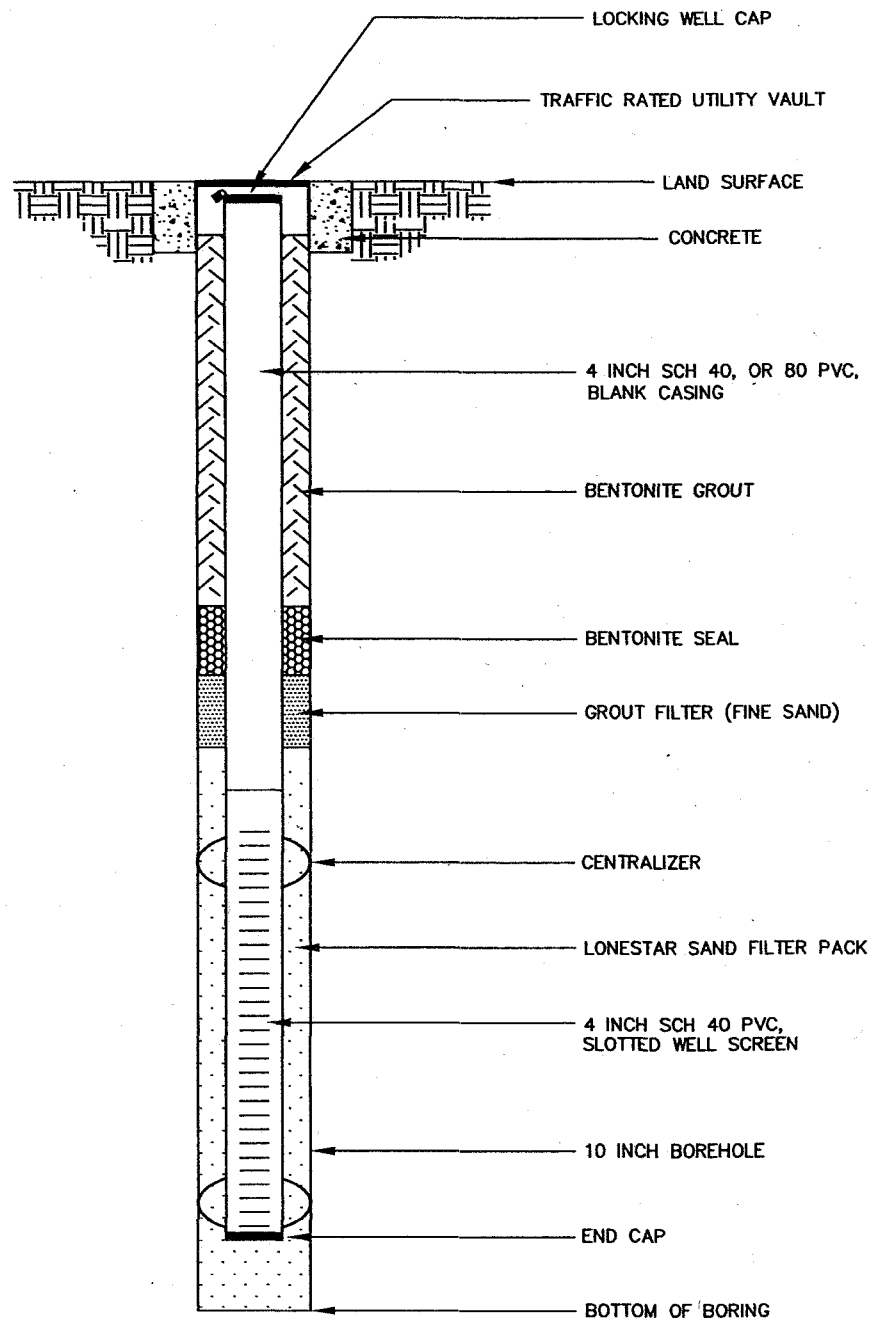
01

[illegible]

ORIGINAL: LABORATORY

**YELLOW: QA MANAGER**

**PINK: FIELD/TASK MANAGER**



UPPER BELLFLOWER AQUITARD MONITOR WELL

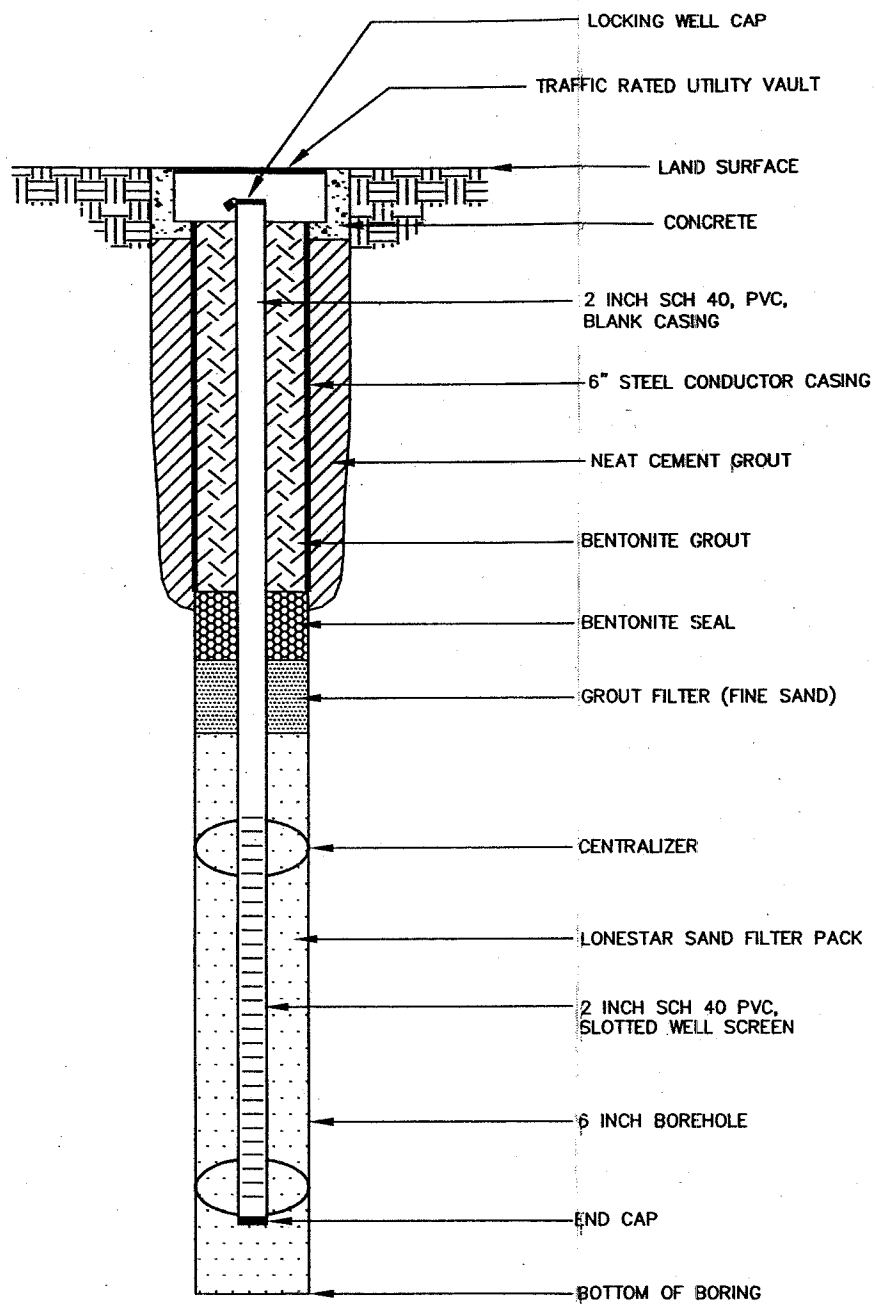
NOTES:

PVC = POLY VINYL CHLORIDE  
DRAWING NOT TO SCALE



**HARGIS + ASSOCIATES, INC.**  
Hydrogeology/Engineering

**FIGURE 1**  
**SCHEMATIC MONITOR WELL**



BELLFLOWER SAND AND GAGE AQUIFER MONITOR WELLS



HARGIS + ASSOCIATES, INC.

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN  
TCE PLUME DATA ACQUISITION  
MONTROSE SITE  
TORRANCE, CALIFORNIA

APPENDIX B  
FINAL  
QUALITY ASSURANCE PROJECT PLAN  
TCE PLUME DATA ACQUISITION  
MONTROSE SITE  
TORRANCE, CALIFORNIA

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-----	--------------------------------------



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ATTACHMENTS

Attachments

- B-1 DEL MAR ANALYTICAL QUALITY ASSURANCE PROGRAM MANUAL  
- CD ROM
- B-2 WEST COAST ANALYTICAL SERVICE, INC. QUALITY ASSURANCE MANUAL  
- CD ROM

ACRONYMS AND ABBREVIATIONS

BHC	Hexachlorocyclohexane
DDT	Dichlorodiphenyltrichloroethane
DMA	Del Mar Analytical, Inc., Irvine, California
DO	Dissolved oxygen
DQOs	Data Quality Objectives
DVPs	Data validation packages
EC	Electrical conductivity
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan for TCE Plume Data Acquisition
H+A	Hargis + Associates, Inc.
ISGS	In-Situ Groundwater Standards
LDC	Laboratory Data Consultants, Carlsbad, California
MACP	Monitoring and Aquifer Compliance Program
Montrose	Montrose Chemical Corporation of California
MSDs	Matrix spike duplicates
NTUs	Nephelometric Turbidity Units
PARCC	Precision, accuracy, representativeness, completeness, and comparability
pCBSA	parachlorobenzene sulfonic acid
%R	Percent recovery
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RI	Remedial Investigation
ROD	Record of Decision



ACRONYMS AND ABBREVIATIONS (continued)

RPD	Relative percent difference
SDG	Sample delivery group
the Site	Montrose Chemical Corporation of California Site
SOPs	Standard Operating Procedures
SOW	Statement of Work
TCE	Trichloroethylene
UAO	Unilateral Administrative Order
VOCs	Volatile organic compounds
WCAS	West Coast Analytical Service, Inc., Santa Fe Springs, California
Workplan	Workplan for TCE Plume Data Acquisition

APPENDIX B  
FINAL  
QUALITY ASSURANCE PROJECT PLAN  
TCE PLUME DATA ACQUISITION  
MONTROSE SITE  
TORRANCE, CALIFORNIA

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared for Montrose Chemical Corporation of California (Montrose) in accordance with the requirements outlined in Section 1.1 of the Unilateral Administrative Order (UAO) Statement of Work (SOW), First Amendment (U.S. Environmental Protection Agency [EPA], 2004). This QAPP is a companion document to the Workplan for Trichloroethylene (TCE) Plume Data Acquisition (Workplan) and the associated Field Sampling Plan for TCE Plume Data Acquisition (FSP).

1.1 DEFINITION OF TERMS

To facilitate the discussion within this document, several defined terms are used as described below. For clarity of discussion only, this report will refer to the "Property" as the area within the fenced property boundary located at 20201 South Normandie Avenue, in Los Angeles, near Torrance, California (Figure 1). The term "central process area" refers to an approximate two-acre portion of the Property where most of the manufacturing operations were performed historically.

The term TCE as used in the Workplan refers to trichloroethylene and the family of chlorinated solvents as described in the Record of Decision (ROD) for the Montrose Site (the Site) (EPA, 1999a). In addition, the term dichlorodiphenyltrichloroethane (DDT), or total DDT, will be used to refer to the sum of the isomers and metabolites of DDT. The term



hexachlorocyclohexane (BHC), or total BHC, will be used to refer to the sum of the isomers of BHC.

## 1.2 OBJECTIVES AND SCOPE

In accordance with the UAO SOW Section 1.1, the objectives of the TCE plume data acquisition are to:

- Provide a description of the current data on the TCE plume distribution and potential sources.
- Provide an identification of current data gaps with respect to the distribution and potential sources of the TCE plume to assist in directing the acquisition of additional data.
- Provide the identification and rationale for the number and locations of monitoring wells to be installed to meet the requirements of the ROD with respect to the TCE plume.
- Identify the property owners at the proposed well locations and anticipate issues regarding long-term and short-term property access.
- Provide a complete description of proposed well construction details; drilling methods and equipment; construction materials; borehole, casing and annular spacing measurements; depths of screened and blank casing intervals; proposed pump, transducers and other dedicated or temporary downhole equipment.
- Provide a description of well development procedures.
- Provide a description of the treatment and/or disposal of development water, drilling fluids and other potentially contaminated media.

- Provide the groundwater sampling procedures and chemical and physical parameters to be included in the sample analysis of the new wells, pending incorporation into the overall monitoring plan.

The first four bullets are addressed in the Workplan. The last four bullets are addressed in the associated FSP (Appendix A).

### 1.3 SUPPORTING DOCUMENTS

This QAPP was developed in accordance with the EPA guidance document "EPA Guidance for Quality Assurance Project Plans, Document Control No. EPA QA/G-5" (EPA, 1998a). Site specific documentation is also provided in the "Final Remedial Investigation Report for the Montrose Superfund Site, Los Angeles, California" (EPA, 1998b), and in the accompanying Workplan and FSP.

### 1.4 BACKGROUND

Background information related to the Site is outlined in section 2.0 of the associated FSP (Appendix A).

#### 1.4.1 Site Description

A description of the Site is provided in Section 2.1 of the FSP (Appendix A).

#### 1.4.2 Previous Investigations

Previous groundwater investigations at the Site are summarized in Section 2.5 of the Workplan and FSP and in the Remedial Investigation (RI) report (EPA, 1998b). Groundwater data





obtained from these investigations are contained in the Montrose Groundwater database, described in the Data Management Plan (Hargis + Associates, Inc. [H+A], 2004).

#### 1.4.3 Geologic and Hydrogeologic Conditions

The geologic setting, stratigraphy, and hydrogeologic conditions at and in the vicinity of the Site are described in Sections 2.2 and 2.3 of the associated Workplan.

## 2.0 DATA QUALITY OBJECTIVES

The data quality objectives (DQOs) for this study were developed in accordance with the EPA guidance document "Guidance for the Data Quality Objectives Process", EPA QA/G-4 (EPA, 2000). The DQO process outlined in the EPA guidance is designed to provide systematic planning in data collection efforts. The data collection efforts resulting from such planning should support the decision making process. This section of the QAPP is designed to parallel the EPA guidance for the DQO process to the extent possible. Therefore, this section will discuss the steps specified in the DQO process as outlined in the EPA guidance (EPA, 2000). As described by EPA, the DQO process is especially designed to address problems that require making a decision between two clear alternatives. However, the principles used in the DQO process are also applicable to programs with objectives other than decision making, such as the TCE Plume Data Acquisition work. The basic steps in the DQO process are:

- 1) State the Problem
- 2) Identify the Decision
- 3) Identify the Inputs to the Decision
- 4) Define the Boundaries of the Study
- 5) Develop a Decision Rule
- 6) Specify Tolerable Limits on Decision Errors
- 7) Optimize the Design for Obtaining Data

### 2.1 STATE THE PROBLEM

The data collection activity addressed in this document is the TCE Plume Data Acquisition work, which is described in Section 1.1 of the UAO SOW (EPA, 2004). The principal objective for this work is to provide data regarding the TCE contamination emanating from the Boeing Realty Corporation and International Light Metals properties. The data will also be used in the remedial design modeling program, to evaluate whether or not additional wells are needed for monitoring in accordance with the UAO SOW Section 1.1.



## 2.2 IDENTIFY THE DECISION

As noted in the EPA guidance, the DQO process is particularly designed to address problems that require making a decision between two clear alternatives. However, the principles of systematic planning and the DQO process are applicable to all scientific studies (EPA, 2000). Therefore, the DQO process will be applied to this phase of data collection to the extent practicable.

As part of the decision process, the planning team and decision makers should be identified. For this project, the members of the planning team include hydrogeologists from H+A, Montrose personnel, and EPA personnel including the Remedial Project Manager and Quality Assurance Management Section representatives. Decisions will be made by consensus between the EPA, Montrose, and H+A.

The TCE plume data acquisition will provide additional characterization of the TCE plume for the remedial design modeling program. Based on analysis of the results of the sampling activities, the current location of the contaminant plume and the chemical concentration within the TCE plume will be established.

The sampling will provide additional information for compliance and operational monitoring to be performed in accordance with the Monitoring and Aquifer Compliance Program (MACP). An objective of the sampling is to obtain data sufficient to monitor changes in the lateral and vertical distribution of TCE in groundwater at the Site. The data will also be used to evaluate the need for additional monitor wells.

## 2.3 IDENTIFY THE INPUTS TO THE DECISION

The TCE Plume Data Acquisition work will consist of the drilling and installation of five monitor wells at the Site. Monitor wells will be installed in the upper Bellflower aquitard, Bellflower sand, and the Gage aquifer. In order to meet the objectives outlined in Section 1.2, groundwater

samples will be analyzed for volatile organic compounds (VOCs) using EPA Method 8260B. To provide information on baseline conditions in the vicinity of the wells, samples will also be collected for parachlorobenzene sulfonic acid (pCBSA) using modified EPA Method 314.0; for DDT and its isomers and metabolites; BHC isomers, other organochlorine pesticides using EPA Method 8081A, general minerals and California Title 22 metals. Tables B-4 through B-8 included in this QAPP summarize the analytical methods to be used, and the analytes for each method. The following summarizes the analytical methods included in the tables:

TABLE	ANALYTICAL METHOD INFORMATION
B-4	VOCs
B-5	Organochlorine Pesticides
B-6	PCBSA
B-7	General Minerals
B-8	California Title 22 Metals

The selected analyses are based on the known contaminants released at the Site and the historical concentrations of those contaminants in groundwater. These analyses are described in the FSP.

#### 2.4 DEFINE BOUNDARIES OF THE STUDY

Monitor wells are currently located across the Site, and are screened in the following hydrostratigraphic units:

- upper Bellflower aquitard
- Bellflower sand
- Gage aquifer
- Lynwood aquifer.

Project specific goals for the detection limit of each analyte consist of in situ groundwater standards (ISGS). Where applicable, the ISGS for VOCs are included in Table B-4, and the



ISGS for organochlorine pesticides are included in Table B-5. The project goals for accuracy, precision, and completeness are also included in Tables B-4 through B-8. The proposed method detection limits have been set to be below the ISGS for VOCs and organochlorine pesticides.

The TCE Plume Data Acquisition well installation and sampling program will be implemented after EPA has approved this QAPP and the associated Workplan and FSP. Additional monitor wells will be installed in the upper Bellflower aquitard, Bellflower sand, and the Gage aquifer at the locations shown in the associated FSP (Appendix A).

No monitor wells are proposed to be installed in the Lynwood aquifer. TCE has not been detected in groundwater samples collected from any of the seven existing Lynwood aquifer monitor wells to date. This includes Lynwood aquifer monitor well LW-3, which is located adjacent to Gage aquifer monitor well G-14 that has had the highest TCE concentration of 130 micrograms per liter detected to date. In addition, the aquitard separating the Gage and Lynwood aquifers is of substantial thickness ranging from approximately 10 to 20 feet thick, appears to be laterally continuous, and is composed primarily of silt and clay sediments which have a very low vertical hydraulic conductivity. This is also supported by the head difference of 13 to 14 feet that occurs across this aquitard. These factors suggest that contaminants would be strongly attenuated if they were able to penetrate the Gage-Lynwood aquitard. Because of this, and given the relatively low TCE concentrations detected in the Gage aquifer, it is believed that construction of additional Lynwood aquifer wells is not warranted.

## 2.5 DEVELOP A DECISION RULE

The proposed TCE plume data acquisition is designed to provide additional characterization of the TCE plume for remedial design purposes and information about the TCE plume and the sources of TCE contamination. The monitoring and sampling of the additional wells will provide a basis for future work at the Site and will support the development of the MACP. The data developed by this work will be integral to future decisions on remedial activities.

The following provides a summary of the purposes of the TCE plume data acquisition, and the associated decision:

PURPOSE	DECISION
<ul style="list-style-type: none"><li>Data will be used to provide TCE plume definition data for the remedial design model.</li></ul>	<ul style="list-style-type: none"><li>Determine if additional wells are necessary for remedial design modeling.</li></ul>

The goal of the TCE plume data acquisition is to obtain data necessary to more completely characterize the extent of the TCE contamination, and to identify and characterize potential upgradient, non-Montrose sources of TCE that may impact the remedial design.

## 2.6 SPECIFY TOLERABLE LIMITS ON DECISION ERRORS

Results of this data collection and evaluation effort will provide information for future remedial decisions and activities. This baseline evaluation of current site conditions and distribution and location of the TCE plume and additional sources will be assumed to be true.

Acceptable limits on the data itself are discussed in the Data Acquisition section of this QAPP (Section 4.0). Although the complete range of variables for the parameters to be collected is not known, previous sampling and laboratory analyses have provided the basis for determining which analyses will be performed as part of the baseline study. Previous sampling and laboratory analyses results, as summarized in the RI report, provide an approximation of the expected ranges of concentrations of contaminants in groundwater at the Site, as well as the expected ranges of water level elevations in the various hydrostratigraphic units underlying the Site (EPA, 1998b).

## 2.7 OPTIMIZE THE DESIGN FOR OBTAINING DATA

Based on results of the TCE plume data acquisition, additional monitor wells may be required. Additional wells may also be required to meet the objectives of the MACP, to be prepared by

EPA, in accordance with UAO SOW Task 11 (EPA, 2004). The decisions regarding whether or not additional wells will be installed, and the monitoring and sampling schedule for those wells, will be made following the completion of the work.

Two rounds of groundwater samples will be collected from the newly installed wells. An initial round of groundwater samples will be collected after monitor well construction and development has been completed. Groundwater samples collected during the initial round will be analyzed for VOCs; pCBs; DDT, BHC and other organochlorine pesticides; metals; and general minerals to provide baseline information regarding general water quality as well as the nature and extent of VOCs in the area upgradient of the Montrose Property.

The second round of groundwater samples will be collected approximately two weeks following the initial round of groundwater sampling. This will allow sufficient time to review the preliminary laboratory results from the initial round for anomalous data prior to conducting the second groundwater sampling round. Groundwater samples collected during the second groundwater sampling round will be analyzed for VOCs to confirm the distribution of TCE and other VOCs obtained during the first round.

Future sampling of the wells installed as part of the TCE Plume Data Acquisition will be concluded in accordance with the sampling schedule of the MACP, which is being prepared by EPA.

The Workplan and FSP for the TCE Plume Data Acquisition contain specific recommendations regarding locations and completion intervals for five additional monitor wells. These recommendations were based on the recent TCE data available to satisfy the objectives contained in the SOW, and listed in Section 1.2.

### 3.0 TASK MANAGEMENT

This section describes the overall structure of the project in terms of its management team and its quality assurance (QA) team, and provides an overview of the tasks to be performed under the FSP. In addition, this section describes the types of data that will be generated in the course of the TCE plume data acquisition, as well as the data quality requirements that will allow these data to be interpreted and integrated into a conceptual understanding of subsurface processes that govern the movement of groundwater and contaminants, including TCE in groundwater.

#### 3.1 TASK ORGANIZATION

A project organization chart has been prepared for the tasks specified in the FSP, and lists H+A, EPA, and subcontractor personnel responsible for implementation of field and QA activities (Figure 1). QA activities at the Site will be overseen by a QA team comprised of the following project personnel: Project Manager, Technical Directors, QA Managers, and Field Task Managers. The QA team is responsible for ensuring that valid measurement data are obtained and for routinely verifying laboratory and field measurement data. The following sections describe the responsibilities of the individual members of the QA team.

##### 3.1.1 Project Manager

The Project Manager is responsible for general project supervision, including reviewing the activities of the QA Manager and the individual Field Task Managers. The Project Manager will directly perform or supervise the performance of the following:

- Coordinate and oversee project-related activities and data management.





- Ensure that the procedures specified in this QAPP and in the FSP are implemented and that all activities conducted at the Site meet stated objectives.
- Determine sampling and analytical strategies with the assistance of the QA team.
- Ensure that data meet project specific objectives.
- Review data quality verification results.
- Review and approve project documents.
- Approve, designate, and monitor corrective action of all field and office activities, as needed.
- Act as H+A liaison to Montrose and EPA.

### 3.1.2 EPA Project Manager

The EPA Project Manager bears overall responsibility for the direction of the scope of work to be performed for the project. The EPA Project Manager provides final review and approval of the FSP and this QAPP, and the reports that will be generated upon conclusion of each groundwater sampling event. The EPA Project Manager provides coordination of the overall project, and provides consultant overview and direction.

### 3.1.3 Technical Directors

The Technical Directors will review the implementation of field, laboratory, and office procedures to ensure that the proposed work is conducted in accordance with methods and procedures designated in the FSP and this QAPP. The Technical Directors will be available to assist the

Project Manager as needed to evaluate data quality with respect to project objectives and to interpret data generated during groundwater sampling.

#### 3.1.4 Quality Assurance Managers

The H+A QA Manager is responsible for informing field personnel of the quality control (QC) practices to be employed prior to field work; performing and overseeing QA/QC functions throughout field and laboratory activities; and communicating QA/QC status and requirements to the Project Manager and, if required, to Technical Directors. The QA Manager will directly perform or supervise the performance of the following:

- Coordinate QA/QC functions with the Project Manager.
- Review and approve all QA/QC documents pertaining to Site activities.
- Review and approve all modifications to this QAPP, as necessary, and distribute modifications to all parties.
- Coordinate all field sampling efforts with the analytical laboratory.
- Maintain a record of all samples submitted for analysis to the laboratory, the analyses performed, and the final results.
- Ensure that proper sample custody procedures are followed.
- Review chain-of-custody records and sample transmittal documents for completeness.
- Ensure that appropriate field measurement data and analytical laboratory data are entered, stored, and maintained.



- Perform the verification and validation of the quality of data and review analytical results with project personnel.
- Monitor progress in correcting laboratory deficiencies, if necessary.

The H+A QA Manager and other members of the H+A QA team will be assisted as needed by a consulting QA Manager for Laboratory Data Consultants, Carlsbad, California (LDC). The LDC QA Manager will be available to review verification and validation of the quality of data in order to assure that data quality achieved during field and laboratory procedures meets DQOs designated for the project.

The EPA Project QA Officer will be responsible for review of QA documents, including QAPPs, submitted pursuant to a Task Assignment. The EPA Project QA Officer provides comments and recommendations to the EPA Project Manager regarding appropriate methodologies, reporting limits, sampling, and preservation techniques, DQOs, and other chemistry related issues. The EPA Project QA Officer performs data validation tasks or assigns and supervises EPA data validation tasks as requested by the EPA Project Manager.

### 3.1.5 Field Task Managers

Field Task Managers are responsible for overseeing all field activities, for communicating field activities with the Project Manager, and for coordinating all sampling efforts with the H+A QA Manager and the analytical laboratories. The Field Task Managers, to be assigned prior to scheduled activities, will:

- Contact off-site private property or facility owners and obtain permission to conduct field activities, if required.
- Coordinate field activities with all permitting agencies and subcontractors and establish contractual agreements, as necessary.



- Provide training for all sampling personnel, as necessary. Training may include sample collection procedures and decontamination procedures. All Field Task Managers and field personnel will be required to be in compliance with applicable H+A corporate health and safety requirements, as well as Occupational Safety and Health Administration training requirements for hazardous waste sites.
- Coordinate all sampling efforts with field personnel and the H+A QA Manager.
- Prepare a sampling memorandum before each sampling event that indicates the sampling methodology; number, type, and size of samples to be collected; and preservation and analytical methods required. The Field Task Manager will review this memorandum with field personnel prior to sampling.
- Designate sampling locations and assign sample identifiers for associated QC samples, which will be comprised of trip blanks, field blanks, duplicate samples, and laboratory split samples.
- Ensure that all field supplies and equipment, including sampling equipment, containers, labels, custody seals, preservatives, and shipping supplies necessary to properly sample wells, are available and are in good working order.
- Ensure that field personnel adhere to the procedures documented in this QAPP unless field conditions require project modifications.
- Review field notebooks and ensure that all appropriate field data forms are complete and correct.
- Coordinate corrective action, as necessary, for all field activities.



### 3.1.6 Laboratory Project Managers

The Laboratory Project Manager ensures laboratory resources are available; reviews final analytical reports produced by the laboratory; reviews and approves the laboratory quality assurance manual; coordinates scheduling of laboratory analyses; and supervises in-house chain-of-custody procedures.

Laboratories specified for this project are Del Mar Analytical, Inc., Irvine, California (DMA) and West Coast Analytical Service, Inc., Santa Fe Springs, California (WCAS).

### 3.1.7 Specialized Training, Requirements, and Certifications

All personnel responsible for and involved in the implementation of the activities described in the FSP and this QAPP will be thoroughly knowledgeable and experienced in the various aspects of the work to be completed. This knowledge and experience will include, but not be limited to, familiarity with the Site geologic and hydrogeologic conditions; laboratory data review and verification; Site physical conditions and access; Site personnel and contacts; and Site health and safety rules, procedures, and protocols. Onsite field personnel will have 40-Hour Hazardous Waste Operations and Emergency Response training and current 8-Hour Refresher Training in accordance with 29 CFR 1910.120. Field personnel will also have certification of current respirator fit testing and first aid training. All onsite field work will be conducted in accordance with the Site-specific Health and Safety Plan (H+A, 2003).

Subcontractors involved in the implementation of project activities will be similarly knowledgeable and experienced. In addition to knowledge and experience, subcontractors will also possess the following minimum requirements:

- Drillers – A qualified driller will have appropriate equipment capabilities, a California C-57 license, experience on similar projects, and documentation of health and safety training. This experience requirement shall apply both to the individual driller in the field and to the drilling company as a whole.



- Waste Handler – Qualified waste handler will have appropriate equipment capabilities and proper state and federal Department of Transportation licenses.
- Analytical laboratory – Certified by the California Department of Health Services to perform laboratory analyses within the state of California.

### 3.2 TASK DESCRIPTION

Monitor well drilling and installation will consist of the construction of five additional monitor wells, in the upper Bellflower aquitard, the Bellflower sand, and the Gage aquifer. The proposed well locations are shown in the associated FSP (Appendix A).

Groundwater monitoring under the FSP will consist of two rounds of water level measurement and groundwater sampling for each new monitor well. Water levels will be measured and groundwater samples will be collected following well development, and again approximately two weeks following the initial sampling.

Water levels will be measured using calibrated two-wire electric water level sounders. Depth to water will be measured from surveyed reference points. Water level elevations will be calculated as the difference between the surveyed or estimated reference point elevation and the depth to water for each well. Water level data will be recorded on preprinted water level data sheets. Water level measuring equipment will be decontaminated between measuring of wells.

Representative groundwater samples will be collected from monitor wells for chemical analysis. At a minimum, the parameters temperature, pH, and electrical conductivity (EC) of the purge water will be measured to ensure that they have stabilized prior to sampling. In addition, dissolved oxygen (DO), oxidation-reduction potential, and turbidity may be measured in the field and recorded in the field notebook.

Groundwater samples will be analyzed for VOCs using EPA Method 8260B; for pCBA using Modified EPA Method 314.0; for DDT and its isomers and metabolites, BHC isomers, and other organochlorine pesticides using EPA Method 8081A; and general minerals and California Title 22 metals in accordance with the appropriate EPA method (Tables B-4 through B-8).

### 3.3 DOCUMENTATION

QA objectives require that field and laboratory activities be documented as completely and accurately as practicable.

#### 3.3.1 Field Activity Documentation

Field documentation includes field notebooks, lithologic logs, well completion and development forms, well construction schematics, water level data sheets, groundwater sampling forms, sample labels, and chain-of-custody forms. Field data forms not submitted with samples to the laboratory will be compiled in the field notebook. Additionally, field notebooks will include a record of significant events, observations, and measurements made during field investigations, including names of personnel present, Site conditions, drilling conditions, sampling procedures, measurement procedures, and calibration records. All field data forms will be signed, dated, and kept as a permanent record. Erroneous entries on the field data forms will be corrected by drawing a line through the error and entering the correct information. Corrections will be initialed by the individual making them.

Field notebooks and copies of field data forms will be reviewed by the Field Task Manager. Field notebooks and field data forms will be retained in the project files. The Field Task Managers will be responsible for the collection and maintenance of field documentation until those documents are forwarded to the project file.

A record of sample identification will be maintained on the field data forms. Standard sample documentation procedures are established for sampling activities to ensure control of samples during collection, transportation, and storage. Sample documentation includes the preparation



of sample identification and transmittal documents so that sample identification can be maintained and sample location and disposition can be monitored and controlled. The following sample identification and transmittal documents will be used:

- Field data forms
- Sample identification labels
- Custody seals
- Chain-of-custody records

Pre-printed, adhesive, sample identification labels will be secured to the sample containers by the field sampler (Table B-2). Sample documentation forms and labels will be completed using waterproof ink. Sample identification labels will contain the following information:

- Sample location/identifier
- Date and time sample was collected
- Analyses to be performed
- Project number
- Sampler initials
- Preservation method used

Custody seals will be used to seal each sample container following collection of samples. In addition, the ice chests used to store samples for transmittal to the laboratory will be sealed closed with filament tape and at least two custody seals will be placed across the contact between the ice chest lid and the ice chest, on sides without hinges. The custody seals will indicate whether any tampering occurred during handling and shipment.

Official sample custody will be maintained and documented from the time of sample collection to the presentation of analytical results in the final report. The chain-of-custody records will document the transfer or shipment of samples to the analytical laboratory personnel and will detail the analyses requested for each sample (Table B-3).





Chain-of-custody records will contain the following information:

- Sample location/identifier
- Project code
- Date and time sample was collected
- Project Manager and QA Manager names, telephone number, and fax telephone number
- Names of sampling personnel
- Shipping method used and date
- Sample description
- Sample matrix
- Sample volume and number of containers
- Sample destination
- Preservation method used
- Analyses to be performed
- Special handling procedures

Erroneous entries on chain-of-custody records will be corrected by drawing a line through the error and entering the corrected information. Corrections will be initialed by the individual making them.

### 3.3.2 Laboratory Documentation

In general, laboratories will document their activities in accordance with their QA Manuals (Attachments B-1 and B-2). Laboratory documentation elements have been summarized below:

- Analytical Report:
  - Client Name and Address
  - Sampling Date
  - Receipt Date
  - Project Name
  - Sample Description/ID
  - Analysis Reported
  - Analytical Results and Units



- Sample Surrogate Recoveries
- Method of Analysis
- Analyst

➤ QA Package:

- Chain-of-Custody
- Case Narrative
- Non-Conformance Reports/Corrective Action
- QC Report [Recoveries and Limits for Matrix Spike, Matrix Spike Duplicate]
- Method Blank Results and Surrogate Recoveries
- Internal Standard Recoveries
- Bench Sheets
- Raw Analytical Data
- Preparation Logs
- Instrument Sequence Logs
- Initial Calibration Curve or Standards
- Instrument Performance Checks
- Continuing Calibration Check
- Laboratory Control Standards

Chain-of-custody records will be reviewed by the QA Manager for completeness. The analytical laboratory will notify the QA Manager of sample receipt and will acknowledge receipt of samples on the chain-of-custody record.

## 4.0 DATA ACQUISITION

This section summarizes standard operating procedures (SOPs) for sample collection and sample custody, as well as QC procedures for field measurements, sample collection, and laboratory analyses to be used during activities at the Site. The purposes of these procedures are to ensure proper handling of samples during collection, transportation, storage, and analysis, and to ensure that all field measurements are performed in a manner consistent with the DQOs. Laboratory QC procedures used for the analysis of samples are provided by the analytical laboratory (Attachments B-1 and B-2).

### 4.1 DESIGN OF SAMPLING PROCEDURES

Representative groundwater samples will be collected from the newly installed monitor wells for chemical analysis. Groundwater samples will be analyzed for VOCs using EPA Method 8260B; for pCBA using Modified EPA Method 314.0; for DDT and its isomers and metabolites, BHC isomers, and other organochlorine pesticides using EPA Method 8081A; and general minerals and California Title 22 metals in accordance with the appropriate EPA method (Tables B-4 through B-8). The second sample from the well will be analyzed for VOCs using EPA Method 8260B. For any sample requiring dilution, the laboratory will be instructed to report both the diluted and the non-diluted results for VOCs. The types, locations, and number of samples to be collected; procedures for preparation and decontamination of sampling equipment; and methods of waste disposal were determined based on available data and objectives and are provided in the FSP. The field sampling methodology to be employed has also been specified.

Samples designated for laboratory analysis will be identified, preserved, and transported in such a manner that data are representative of the actual Site conditions and sample integrity is maintained during sample transport. Sample handling protocols have been developed for groundwater samples collected at the Site (Table B-1).

SOPs provided in the FSP will be followed during the collection of groundwater samples. If specialized equipment is necessary, arrangements will be made or subcontractors will be contacted by the Field Task Manager. Sampling and measurement equipment will be thoroughly checked for proper operation and calibration prior to any field activity.

#### 4.2 ANALYTICAL METHODS REQUIREMENTS

Groundwater samples will be analyzed for VOCs using EPA Method 8260B, for pCBA using Modified EPA Method 314.0; for DDT and its isomers and metabolites, BHC isomers, and other organochlorine pesticides using EPA Method 8081A; and general minerals and California Title 22 metals in accordance with the appropriate EPA method. Analytical methods used for this project will meet the requirements of SW-846 (EPA, 1996) (Tables B-4 through B-8). For any sample requiring dilution, the laboratory will be instructed to report both the diluted and the non-diluted results for VOCs.

#### 4.3 QUALITY CONTROL REQUIREMENTS

QC procedures have been developed for field activities and laboratory analyses to ensure that samples are collected and analyzed in a manner consistent with the DQOs. Field and laboratory QC procedures have been prepared for field instrument and equipment calibration, sample collection, field parameter measurements, and laboratory analyses (Tables B-4 through B-9).

##### 4.3.1 Field Quality Control

QC procedures will be implemented for field measurements to ensure that all field measurements are performed and recorded in a manner consistent with the DQOs. In general, the following steps must be implemented as part of the QC procedures for field measurements:

- Document field equipment maintenance and calibration.



- Establish written SOPs that are accessible.
- Train personnel in all SOPs relating to their assigned tasks.
- Specify professional oversight for various field procedures.
- Maintain well-organized, verified, and accessible data files, including original data and field notes.
- Perform informal, internal peer auditing of work by field personnel and formal auditing by the QA Manager or a designate through interaction with the Project Manager.
- Document any corrective action taken in the field notes.

#### 4.3.2 Sample Collection

QC procedures will be implemented for sample collection to ensure that all groundwater samples are collected in a manner consistent with the DQOs. The Field Task Manager will determine the sampling locations and sample identifiers for QC samples, which will be comprised of duplicate and laboratory split samples collected from the same wells and at the same time as original groundwater samples. The number of QC samples to be collected and QC sampling locations will be confirmed by the QA Manager and will be contained in a field memorandum issued to the field sampling personnel prior to the sampling event. As a general guideline, one duplicate and one laboratory split sample will be collected and analyzed for VOCs for every 10 original groundwater samples collected. The Field Task Manager will direct the selection of the locations of duplicate and split sampling so that QC samples are collected at different locations that are representative of the variability of contaminant concentrations in groundwater throughout the Site vicinity.

QC samples will be identified in the same manner as all other samples so that the laboratory will not be aware of their nature as QC samples. Identifiers will be determined by the Field Task Manager prior to the sampling event and will be indicated on the sampling memorandum.

#### 4.3.3 Laboratory Quality Control

DMA and WCAS are the designated primary and split analytical laboratories, respectively, for sample analyses. Other qualified analytical laboratories may be designated to perform analyses. Laboratory QA objectives and procedures are specified in their respective QA Manuals (Attachments B-1 and B-2). Analytical summaries containing project-specific QC criteria to be followed by the laboratory for analysis of groundwater samples are provided (Tables B-4 through B-8).

#### 4.4 INSTRUMENT CALIBRATION

Field equipment, such as water quality parameter measuring instruments, will be calibrated and used to perform the necessary field measurements, in a manner such that data are representative of the actual Site conditions.

Field equipment will be maintained, calibrated, and operated according to manufacturer guidelines and recommendations. At a minimum, all field equipment will be inspected and calibrated on receipt from a vendor or from another H+A office. The following guidelines apply to equipment calibration:

- Calibrate all field equipment prior to field activities.
- At a minimum, the pH meter will be calibrated in pH 4 and pH 10 buffered solutions prior to commencing field work each day. These pH values are expected to bracket the range of pH in groundwater samples collected from monitor wells at the Site. The conductivity meter will be calibrated prior to commencing field work each day. The conductivity meter will be calibrated using standard calibration solutions selected to bracket the range of



conductivity expected in groundwater samples collected from monitor wells at the Site. The accuracy of the field thermometer will be determined by checking the measured reading against other thermometers. The DO meter will be calibrated in air prior to commencing field work each day. If a photometer-type turbidity meter is used, it will be calibrated to 0 Nephelometric Turbidity Units (NTUs) and 10 NTUs prior to commencing field work each day, and zeroed to 0 NTUs prior to each reading. Depending on the type of meter used, calibration to the parameters EC, pH, DO, and turbidity can be accomplished automatically using the auto-calibration solution provided by the meter's manufacturer. The oxidation-reduction potential meter cannot be calibrated in the field.

- If the calibration of an instrument cannot be easily checked, either test it against another instrument of a similar type or return it to the manufacturer for appropriate calibration on a quarterly basis at a minimum.

A routine schedule and record of field equipment calibration will be maintained in the field notebook. This will enable the user to document the procedures used in verifying the accuracy of the field equipment.

Sufficient critical spare parts, batteries and supplies will be maintained for all field instruments at an easily accessible, on-site storage location to repair or maintain equipment with a minimal impact to field activities.

Specific procedures for calibration, operation, and maintenance of laboratory equipment are described briefly by the analytical laboratory (Attachments B-1 and B-2).

#### 4.5 SAMPLE ANALYSES

Data acquisition requirements for laboratory analysis are described in the following sections.

#### 4.5.1 Laboratory Facilities

Laboratory facility requirements include, but are not limited to, the following:

- The laboratory will have the appropriate equipment available for sample preparation and analysis for the analytical methods requested.
- The laboratory will use reagents and supplies that meet the minimum requirements in the analytical methods.
- All instruments and equipment used for sample analysis will be maintained, calibrated, and operated according to laboratory SOPs, analytical method criteria, and manufacturer guidelines and recommendations.

#### 4.5.2 Sample Custody

Laboratory sample custody procedures include, but are not limited to, the following:

- Sample custody is documented from the time samples are received by the laboratory sample custodian throughout the analytical process, until the samples are disposed.
- Upon receipt at the laboratory, each sample is assigned a unique laboratory identification number that is used to track that sample. The sample identification number will be documented by the laboratory sample custodian on the chain-of-custody record. The temperature inside the cooler containing samples should be measured and recorded on the chain-of-custody record upon receipt at the laboratory.





#### 4.5.3 Analytical Procedures

Generalized standard laboratory analytical procedures include, but are not limited to, the following:

- Analyze samples according to the methods specified (Table B-1).
- Analyze samples within the holding time required by the analytical method or as requested by the sampling personnel, according to the objectives of the particular task, whichever time period is shorter.
- Calibrate each instrument used in the analyses prior to sample analysis to ensure that all analyses meet the method requirements.
- Analyze calibration standard and instrument blanks daily to check instrument consistency and performance.
- Perform continuing calibration verification at the beginning of each day or every 12 hours for EPA Method 8260B.
- Analyze one set of calibration standards each 8-hour shift or every 12 hours, as applicable, or whenever a calibration check standard does not meet project-specific acceptance criteria.
- Analyze one set of method blanks daily or per analytical batch of 20 samples or fewer, whichever is more frequent.
- Analyze at least one spike sample with each analytical batch of 20 or fewer samples.
- Analyze at least one duplicate sample or spike duplicate sample with each analytical batch of 20 or fewer samples.



- Analyze a laboratory control sample and laboratory control sample duplicate with each analytical batch of 20 or fewer samples.
- Compare accuracy and precision from spike and replicate sample analyses to established project-specific QC criteria.
- Maintain performance records to document data quality.
- Use confirmatory methods whenever the identification of an analyte of interest cannot be determined by the main analytical method or when unfamiliar, nonroutine samples are analyzed. Confirmatory methods may include analyses by alternate analytical methods or second-column confirmation for organic compounds, as specified by the appropriate methods.
- Routinely determine the limit of detection or method detection limit for each analyte analyzed on each instrument.
- If dilution is required for one analyte, analyze non-diluted as well as diluted samples to ensure lowest detection limit is attained.

#### 4.5.4 Reporting

Laboratory reporting procedures include, but are not limited to, the following:

- Review analytical data, laboratory worksheets, and QC records, including spike and duplicate analytical results, and maintain on file at the laboratory for future reference.
- Report both diluted and non-diluted results to ensure that the lowest detection limit is attained for all compounds.
- Prepare and submit analytical laboratory reports to H+A.



- Submit data report package consisting of results sheets from each batch of samples and copies of the instrument or method blank, matrix spike and matrix spike duplicate (MSD) summary, and the surrogate or internal standard recoveries. The data package includes all relevant sample information, including laboratory identification number; sample identifier; analytical method; date and time of sample collection, extraction, and analysis; dilution factor; and reported detection limits. Additionally, the data report package shall include results of the laboratory control sample and laboratory control sample duplicate.
- Type all analytical reports and include a cover letter signed by appropriate laboratory personnel, analytical report sheets for each sample, and QA sample results summaries.

Laboratories will provide Tier 3 Data Validation Packages (DVPs) for 100 percent of submitted groundwater samples, as instructed.



## 5.0 DATA QUALITY MANAGEMENT

The data quality management program is designed to ensure that QC procedures are maintained from data collection to report preparation. Data quality management will be initiated prior to data collection by implementing QC procedures established to ensure that all data are obtained and analyzed in a manner consistent with QA objectives and are representative of the actual Site conditions. Laboratory data will be maintained by DMA and WCAS in accordance with their respective QA Manuals (Attachments B-1 and B-2). Montrose will maintain field data for a period of no less than 5 years after EPA determination that the work under the SOW to the UAO is complete, unless otherwise approved by EPA (EPA, 2004). The following sections summarize field and laboratory data quality management and assessment.

### 5.1 DATA MANAGEMENT

Field and laboratory data will be managed as it is obtained and compiled. Field data will be obtained and compiled in field notebooks or on the appropriate field data forms. Laboratory data will be compiled in the data report packages. Field and laboratory data will be entered, stored, and maintained in electronic files or databases, as appropriate. Tables will be prepared based on these data for use in summary reports. Use of these standard data reporting forms and tables will ensure that data are presented consistently. The QA Manager will maintain all copies of field data forms, original transmittal letter, chain-of-custody records, and the laboratory data packages in the project files.

#### 5.1.1 Field Data

The Field Task Manager will retain all field notebooks and copies of all field data forms in the project file. These data files will contain original data and field notes. All files will be well organized, indexed, verified, and accessible.



Field sampling files will be compiled. Field sampling files will include, but are not limited to, the following information:

- Lithologic logs prepared by field personnel during well drilling.
- Records of well construction and development prepared by field personnel.
- Field notes compiled by field personnel during well construction, development, and sampling.
- Field notes compiled by sampling personnel during the sampling event.
- Field data, including sampling data forms and calibration documentation.
- Sample documentation forms, including chain-of-custody records, and courier receipts, as appropriate.

#### 5.1.2 Analytical Data

Analytical data files will be established for all activities. These data files will be organized, indexed, verified, and accessible. Analytical data will include original chain-of-custody records, and laboratory data packages assembled by the laboratory performing the analyses. The laboratory data packages will be provided by the laboratory to H+A as hard copy. Analytical data may also be provided on a diskette or by electronic transmission. Analytical data with corresponding review qualifiers will be entered, stored, and maintained in an electronic database.

Analytical data files will include, but are not limited to, the following information:

- Original chain-of-custody records
- Laboratory analytical reports from all sampling events



- QC sample results, including field duplicates, trip, and equipment rinsate blanks
- Data deliverables packages
- Assessment and validation forms compiled during data evaluation.

## 5.2 QUALITY ASSURANCE OVERSIGHT

The QA Manager is responsible for QA oversight. QA oversight is accomplished by verifying that established QC procedures are followed; by conducting field procedure audits on a regular basis to ensure that the data being collected are reliable, of acceptable quality, and are representative of Site conditions; by identifying deficiencies and ensuring that corrective actions are implemented when necessary; and by reporting project status to project management on a regular basis.

### 5.2.1 Preventive Maintenance

Preventive maintenance includes those activities that must be carried out to minimize downtime of the field and laboratory measurement systems. Specific laboratory preventive maintenance measures are provided by each laboratory in its respective QA Manual (Attachments B-1 and B-2). Procedures for preventive maintenance during sampling and field measurement activities include, but are not limited to, the following:

- Calibrate and check field measurement equipment before use.
- Ensure that critical spare parts for instruments are immediately available in case of equipment failure.
- When practical, ensure that back-up equipment is available.
- If samples are subcontracted by DMA or WCAS, then the contract laboratory shall be held accountable to ensure that all analytical requirements in the QAPP are followed by the subcontractor.



- Identify and review sampling locations and procedures each day prior to starting field activities.
- Ensure that additional materials for sample collection, including containers, caps, labels and chain-of-custody forms, are available onsite.

### 5.2.2 Field Procedure Audits

The QA manager may schedule an audit of field procedures during field activities to evaluate the execution of SOPs. The field procedure audit will consist of observations and documentation of the field activities. Checklists will be used for documenting observations of sampling activities, including:

- Calibration documentation for sampling and measurement instrumentation
- Documentation of adherence to this QAPP and the FSP
- Completion of field notebooks and field data forms
- Sample handling, storage, and transmittal procedures
- Chain-of-custody procedures.

Observations recorded on the completed checklist will be discussed with the Field Task Manager during the audit debriefing. Specific deficiencies noted and recommendations for corrective action and follow up will be discussed at this time. A copy of the completed checklist will be forwarded to the H+A Project Manager. Depending on the severity of the deficiencies, adherence to corrective action recommendations may be verified by a follow-up audit of that deficiency.



### 5.2.3 Technical Systems Audits

A laboratory technical systems audit has been performed for the primary laboratory. Laboratory technical systems audits of split and other laboratories will be conducted on an as needed basis. The laboratory technical systems audit monitors the capability and performance of a laboratory and provides an optional verification of compliance with project-specific and method-specific QC criteria. Each laboratory technical systems audit will include a careful evaluation of equipment and facilities and adherence to SOPs and QC procedures. In addition, double-blind performance samples may be submitted to the laboratory by Montrose or EPA.

Upon completion of the laboratory technical systems audit, an audit report is prepared and copies are distributed to the Field Task Manager and Project Manager. This report outlines the audit approach and presents a summary of results and recommendations. Upon completion of the laboratory technical systems audit, the specific deficiencies are discussed with the Project Manager and laboratory personnel, and recommendations are made for corrective action. Depending on the severity of the deficiencies, adherence to corrective action recommendations may be verified by a follow-up audit.

### 5.2.4 Measurement Performance Criteria

Measurement performance criteria apply to quantitative data generated during the course of this investigation.

Performance criteria for quantitative measurements, such as laboratory analytical data, will be those specified in the QA Manual published by each laboratory associated with this project (Attachments B-1 and B-2). Evaluation of data with respect to performance criteria will be conducted by the QA Manager of each laboratory, and will also be reviewed by LDC and H+A QA Managers.



### 5.3 DATA ASSESSMENT AND DATA VALIDATION

Data assessment and validation is a systematic process of evaluating analytical data against a pre-established set of QC criteria, which is based on project-specific criteria and selected method-specific criteria specified in the appropriate EPA test methods, to determine the quality of the data (EPA, 1996). Data generated from sampling events will be verified and validated to determine if they meet QC criteria. The quality and appropriate use of data obtained will be determined based on the results of routine assessment of 100 percent of the data, on the results of Tier 2 validation procedures performed on 100 percent of the groundwater sampling analytical data, and on the results of Tier 3 validation procedures performed on 20 percent of the groundwater sampling analytical data. Laboratory data will be validated in accordance with EPA National Functional Guidelines (EPA, 1994, 1996, and 1999b). SOPs for data assessment have been developed to ensure that these activities are performed in a consistent manner, Section 6.0, Standard Operating Procedures for Data Assessment.

Analytical data generated will be verified for compliance with H+A criteria for precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters. Assessment and validation of analytical data will be performed under the supervision of the H+A QA Manager. The LDC QA Manager will be responsible for reviewing the results of data validation. The laboratory will submit analytical results that are supported by sufficient information to enable the reviewer to fully evaluate data quality.

The QA Manager will direct the following activities during the data assessment process:

- Review of chain-of-custody records
- Review of sample holding times
- Review of any trip blank and equipment rinsate blank results
- Review of any field duplicate and laboratory split sample results
- Review of laboratory reagent blank, spike, and duplicate sample results.

Data assessment results will be used to flag questionable analytical results and to assign data qualifiers. The results will also be used as a basis to request revised analytical data reports

from the laboratory and to initiate corrective action. In addition, results will be used to determine corrective action for field sampling personnel.

All analytical data will undergo Tier 2 and 20 percent will undergo Tier 3 data validation. The laboratory will, however, provide Tier 3 documentation packages for 100 percent of the samples so that a greater percentage of samples could be subject to Tier 3 validation, if warranted. DVPs will be assembled by the laboratory performing the analyses.

EPA Tier 2 data validation will be performed on the summary (i.e., no raw data) packages for analyses of groundwater samples analyzed by EPA and non-EPA methods. The data reviewer will request any missing information from the laboratory and facsimile a copy of this request to the client's project manager when missing information is requested. The data reviewer will validate all components of the data package even when an individual QC element has rejected the data. All data will continue through the validation process and be qualified and requalified as many times as it fails to meet established criteria. An overall final qualification of results will encompass the impact of individual findings and will be determined using the professional judgment of a senior data reviewer.

Data summary packages provided by the contract laboratory will consist of sample results and QA/QC summaries (equivalent to Contract Laboratory Program [CLP] Forms I through X for organic analyses and Forms I through XIV for inorganic analyses).

EPA Tier 3 data validation will be performed on the summary and raw data packages for analyses of groundwater samples analyzed by EPA and non-EPA methods. The data reviewer will request any missing information from the laboratory and facsimile a copy of this request to the client's project chemist when missing information is requested. The data reviewer will validate all components of the data package even when an individual QC element has rejected the data. All data will continue through the validation process and be qualified and requalified as many times as it fails to meet established criteria. An overall final qualification of results will encompass the impact of individual findings and will be determined using the professional judgment of a senior data reviewer.



All data validation procedures will be in accordance with EPA Functional Guideline requirements and industry standards.

The QC elements to be reviewed for Tier 2 and Tier 3 validation are identified in the following subsections.

#### Organic Analyses

- Holding times
- Initial calibration
- Continuing calibration
- Blanks
- Surrogate recovery
- Matrix spike and matrix spike duplicate recovery
- Laboratory control sample recovery
- Internal standard performance
- Field duplicate sample analysis relative percent difference (RPD)
- Reporting limits
- Compound identification (Tier 3)
- Compound quantitation and detection limits (Tier 3)
- Tentatively identified compound verification (Gas Chromatograph/Mass Spectrograph) (Tier 3)
- System performance (Tier 3)
- Overall assessment of data in the Sample Delivery Group (SDG)

#### Inorganic Analyses

- Holding times
- Initial calibration

- Continuing calibration
- Blanks
- Surrogate recovery
- Matrix spike recovery
- Duplicate sample RPD
- Laboratory control sample recovery
- Inductively Coupled Plasma interference check
- Matrix spike duplicate (MSD) and serial dilution checks
- Field duplicate sample analysis RPD
- Reporting limits
- Analyte identification (Tier 3)
- Analyte quantitation and detection limits (Tier 3)
- System performance (Tier 3)
- Overall assessment of data in the SDG

The results of data assessment and validation, including the activities described above and any data qualified, will be compiled for each sampling event. These results will be kept on file with a memorandum that explains the reasons for data qualifications and the corrective action to be implemented.

The results of data assessment and validation will be used in conjunction with other validation criteria to flag questionable analytical results and to assign data qualifiers. The results will also be used as a basis to request revised analytical data reports from the laboratory and to initiate corrective action.

Following data assessment and validation, analytical results and review qualifiers will be entered into the database from analytical data reports provided by the laboratory. The database will be used to ensure that the data are organized and easily accessible. A hard copy database



printout will be double-checked against the original laboratory analytical reports to ensure data entry accuracy.

### 5.3.1 Data Assessment

Routine procedures will be used to assess PARCC parameters as required to meet DQOs for the sampling event (Table B-10). Descriptions of the PARCC parameters to be evaluated during data verification are described in the following sections. In addition to these parameters, the following criteria will be verified to have been met:

- Holding times;
- Correct analytical method and data reporting (Table B-1);
- Chain-of-custody criteria and documentation; and
- Minimal reporting requirements.

#### 5.3.1.1 Precision

Precision is a measure of the agreement or reproducibility among replicate measurements. Examination of precision is a measure to evaluate the reproducibility of measurements under a given set of conditions. Precision is expressed as the RPD) between duplicates of the same sample. Duplicates consist of internal laboratory duplicates and external field duplicates. Internal laboratory duplicates include sample duplicates and/or MSDs, depending on the analytical method. Analytical results from field duplicate samples provide information on the precision of sample collection procedures. Analytical results from laboratory duplicates and laboratory MSDs provide information on laboratory precision. The RPD between duplicate sample results is calculated using the following equation:

$$RPD = \frac{(D1 - D2)}{(D1 + D2) / 2} \times 100$$

Where:

RPD = Relative percent difference

D1 = First sample value

D2 = Second sample value (duplicate)

The calculated laboratory and field duplicate RPDs are evaluated and compared to established project-specific precision control limits (Tables B-4 through B-8). Unacceptable precision values will be noted in the project file. Data associated with unacceptable laboratory precision results will be qualified, and recommendations for corrective action will be discussed with the laboratory or field personnel, as appropriate.

#### 5.3.1.2 Accuracy

Accuracy is the degree of agreement between a value and an accepted reference or true value. Accuracy can be expressed numerically as the percent recovery (%R) of a spiked sample. A sample spike is prepared in the laboratory by adding a known concentration of one or more chemicals to one sample in each analytical batch. The chemicals spiked are chosen from the list of analytes detectable by the method being evaluated. Analytical results from spiked samples provide data on matrix interferences and method performance.

Accuracy for the analytical measurement system is defined as the %R for a spiked sample. The %R is calculated as follows:

$$P = \frac{(A - B) \times 100}{C}$$

where:

P = Percent recovery

A = Measured concentration in spiked sample (sample + spike)

B = Measured concentration in sample

C = Known concentration of spike compound.



The calculated %R results are compared to project-specific and/or EPA-specified accuracy control limits (Tables B-4 through B-8).

Unacceptable accuracy results will be noted in the project file. Data associated with unacceptable laboratory accuracy results may be qualified, and recommendations for corrective action will be discussed with the laboratory or field personnel, as appropriate.

Accuracy may be qualitatively verified by evaluating blank contamination. Compounds detected in any trip blanks or laboratory blanks will be evaluated during data assessment procedures. Guidelines are established to evaluate the effects of blank contamination on the accuracy of the analytical results of associated field samples. Unacceptable effects of blank contamination will be noted in the project file. Data associated with contamination will be noted in the project file. Data associated with unacceptable blank results will be qualified, and recommendations for corrective action will be discussed with the laboratory and field personnel, as appropriate.

Trip blanks pertain to VOC analysis. When samples for VOC analysis are to be collected, trip blanks are prepared prior to the sampling event and kept with the samples throughout the entire sampling event and during transport to the laboratory. Trip blanks are useful in detecting VOC contamination in sample containers and cross contamination of VOCs between samples during shipment, storage, and handling.

Equipment rinsate blanks are defined as samples that are obtained by running analyte-free, deionized water through any non-dedicated sample collection equipment after decontamination. These samples are used to determine if decontamination procedures are sufficient.

Laboratory blanks are samples made up in the laboratory using analyte-free water and analyzed along with the investigative samples. Laboratory blanks are useful for detecting contamination in the sample handling and analytical processes at the laboratory.

#### 5.3.1.3 Representativeness

Representativeness is the reliability with which a measurement or measurement system reflects the true conditions under investigation. Representativeness is influenced by the number and location of the sampling points; sampling timing and frequency during monitoring events; and field and laboratory sampling procedures.

Representativeness is a qualitative parameter that is addressed by describing sampling techniques and the rationale used to select sampling locations. Sample location selection may be determined based on existing data, instrument surveys, or observations, or may be randomly selected. Data used to select sampling location may include water level measurements; groundwater and soil sample results; geologic descriptions such as lithologic logs; and interpretations of study area hydrogeologic conditions.

#### 5.3.1.4 Completeness

Completeness is defined as a comparison of the number of valid data points obtained from a measurement effort to the total number needed to meet the project goals. Data completeness incorporates sample loss and data acceptability.

Analytical data completeness is described as the ratio of acceptable analytical results to the total number of results requested. A completeness value of less than 90 percent indicates that corrective action is necessary to limit the number of incomplete or unacceptable results and to avoid similar problems in future sampling events.

Criteria for incomplete or unacceptable results may include containers broken during shipment or at the laboratory and data qualified as unusable during data assessment or data validation procedures. Analytical data completeness is calculated using the following equation:

$$C = \frac{(\text{number of acceptable results})}{(\text{total number of requested results})} \times 100$$





where:

C = Percent completeness.

#### 5.3.1.5 Comparability

Comparability is a qualitative parameter that expresses the confidence with which one data set can be compared to another. Comparability is dependent on consistency in sampling conditions and on selection of sampling procedures, sample preservation methods, analytical methods, and expressed units of data.

The comparability requirements for field measurement, sampling, and analysis activities are met by complying with SOPs during sample collection and analysis. Because of the similarity of data collection and analysis methods, data collected during the planned activities will be comparable to data collected during previous Site investigations.

### 5.4 CORRECTIVE ACTION

Corrective action will be implemented if it is determined during the data quality verification and assessment processes that the field procedures and documentation, analytical procedures, or analytical results are not adequate to achieve the DQOs. Corrective actions that may be implemented include, but are not limited to, the following:

- Altering procedures in the field
- Providing additional training for field personnel
- Using alternative sample containers
- Increasing the frequency of calibration or maintenance of field measurement instruments
- Resampling or reanalyzing samples
- Contacting the laboratory to initiate specific internal corrective actions
- Auditing laboratory procedures.



The Project Manager or Field Task Manager will be responsible for initiating corrective action for all field activities. The QA Manager will be responsible for ensuring that corrective actions for laboratory activities are initiated and for ensuring that corrective actions implemented are adequate to meet DQOs. Corrective actions taken will be addressed and summarized in a technical memorandum.

Should field measurement data for analytical results indicate inconsistencies resulting from field procedures, field corrective actions will be implemented as follows:

- Sampling and decontamination procedures will be reviewed if target compounds are detected in any trip blanks or equipment rinsate blanks in concentrations exceeding method reporting detection limits or documented laboratory contaminant levels.
- Sampling and decontamination procedures will be reviewed if analytical results of field duplicates indicate poor precision.

Laboratory corrective actions will be initiated if analytical results are not provided in a timely manner or are determined to contain inconsistencies during the data quality assessment and validation processes. The laboratory will be contacted to discuss corrective action for specific inconsistencies.

At a minimum, the laboratory will adhere to corrective action procedures outlined in Title 40, Code of Federal Regulations, Section 136 or as outlined by EPA (EPA, 1986).



## 5.5 REPORTING

Overall data quality verification results and corrective actions are reported to the Project Manager via the QA Manager. Prior to the preparation of a technical memorandum summarizing field activities, the QA Manager informs the Project Manager of internal analytical data verification checklist results. The QA Manager informs the Project Manager of all corrective actions to be implemented. The Project Manager informs project staff of any corrective action to be followed. All corrective actions taken are recorded in a technical memorandum.



## 6.0 STANDARD OPERATING PROCEDURES FOR DATA ASSESSMENT

Chemical quality data for samples analyzed using various EPA methods will be reviewed during data assessment activities to determine the quality of the data and to assess its use according to the DQOs established for the specific field sampling activity. This SOP has been prepared to ensure that data assessment activities are performed in a consistent manner.

Data assessment procedures will be performed on all analytical data collected as part of routine project activities.

### 6.1 DATA ASSESSMENT PROCEDURES

Data assessment procedures include evaluation of the following categories of support documentation associated with analytical data:

- Sample holding times
- Preservation procedures
- Analytical methods and data reporting
- Field blanks, trip blanks, and laboratory reagent blanks
- Matrix spike recovery
- MSD analysis
- Field duplicate analysis
- Split sample analysis
- Data trending.

Standard procedures will be used to perform routine data assessment of chemical quality data reported by the laboratory and to assign data qualifiers (Table B-11).

Data assessment will be performed using hard copy and/or electronic laboratory reports.

#### 6.1.1 Holding Times

A comparison will be made between the sampling date and the date of laboratory analysis for each sample submitted to the laboratory. The analytical results, including less than detection limit results, for samples identified as exceeding the required holding time will be qualified with "J" and will be documented in the summary memorandum.

#### 6.1.2 Analytical Methods and Data Reporting

The laboratory report will be checked against the sample Chain-of-Custody Record to verify that appropriate analytical results were reported for all samples submitted and that the analytical methods requested in sample documentation were used by the laboratory. Instances of requested analyses not included in the laboratory report, due to occurrences such as breakage in the laboratory, misidentification of samples, missing or incomplete analyses, or use of incorrect analytical methods, will be documented in the summary memorandum.

#### 6.1.3 Field Blanks, Rinsate Blanks, Trip Blanks, and Laboratory Reagent Blanks

The hard copy laboratory reports will be reviewed to determine whether any analytes were detected in any of the field blanks, trip blanks, rinsate blanks, or laboratory reagent blanks associated with the sampling event and analysis procedures. The results of the data search will be documented in the summary memorandum. If an analyte is detected in a blank sample, the following procedures will be performed to identify data subject to qualification:

- Compile a list of blank samples in which analytes were detected including method of analysis, analyte concentration, batch number of water used to prepare the blank, if available, dates of blank sample collection and analysis, and specific laboratory instrument used for blank sample analysis, if applicable.



- For analyte detections in field or trip blanks, review the hard copy laboratory reports for all water samples in which the analyte was detected that were listed on the same chain-of-custody record as the blank sample. Review laboratory reports and identify all detections of the analyte in water samples that were analyzed using the same laboratory instrument, if known, on the same date of sample analysis, using the same analytical method. Compile a list of identified water sample analytical results for qualification.
- For analyte detections in laboratory reagent blanks, review analytical reports and identify all detections of the analyte in water samples that were analyzed on the same laboratory instrument, if known, on the same date of sample analysis, using the same analytical method. Compile a list of identified water sample analytical results for qualification.
- Assign data qualifiers to the compiled list(s) of results as follows:
  - If the concentration of the analyte in the water sample is less than or equal to the concentration in the associated blank, qualify the data with an "R".
  - If the concentration of the analyte in the water sample is greater than the concentration in the associated blank but is less than or equal to five times the blank concentration, qualify the data with a "J".
  - If the concentration of the analyte in the water sample is greater than five times the blank concentration, the data is acceptable.
- Document the review of blank samples and list data qualified in the summary memorandum.

#### 6.1.4 Matrix Spike Recovery

Matrix spike recovery data in the laboratory report will be compared with the acceptable range of %R for each analyte (Tables B-4 through B-8). If a matrix spike recovery percentage is less

than the minimum acceptable %R, the following procedures will be used to identify data subject to qualification:

- Compile a list of analyte matrix spike recoveries that are less than the minimum acceptable percent recovery, along with sample identifiers and date of spike sample analysis.
- Review the analytical reports to identify all water samples analyzed for the same analyte, for the same analytical method, and on the same date of matrix spike analysis. Compile a list of identified analytical results for qualification, including all less than detection limit results.
- Assign the data qualifier "J" to all analytical results on the compiled list.
- Document the review of matrix spike recovery data and list data qualified in the summary memorandum.

If a matrix spike %R is greater than the maximum acceptable %R, the following procedures will be used to identify data subject to qualification:

- Compile a list of matrix spike recovery values that are greater than the maximum acceptable %R, along with sample identifiers and date of spike sample analysis.
- Review the analytical reports to identify all water samples analyzed for the same analyte, for the same analytical method, and on the same date of matrix spike analysis. Compile a list of identified analytical results for qualifications. Do not include less than detection limit results.
- Assign the data qualifier "J" to all analytical results on the compiled list.
- Document the review of matrix spike recovery data and list data qualifiers in the summary memorandum for the data assessment.



#### 6.1.5 Matrix Spike Duplicates

MSD data in the laboratory report will be compared against the acceptable RPDs (Tables B-4 through B-8). If a MSD analysis for an analyte exceeds the acceptable RPD for the analyte, the following procedures will be used to identify data subject to qualification:

- Compile a list of analytes for which MSD RPDs are greater than the acceptable RPD for that analyte, including sample identifier of the MSD sample and date of MSD analysis.
- Review the analytical reports to identify all water samples analyzed for the same analyte, using the same method, on the same date of MSD analysis. Compile a list of identified analytical results for qualification, including less than detection limit results.
- Assign the data qualifier "J" to all analytical results on the compiled list.
- Document the review of MSD analyses and list data qualified in the summary memorandum.

#### 6.1.6 Field Duplicates

The analytical results for field duplicate samples will be tabulated and RPDs for each analyte will be computed. Instances in which an analyte was not detected in both samples will be identified. Instances in which an analyte was detected in only one sample and not in its duplicate sample will also be identified, and an approximate RPD will be calculated by substituting the analytical detection limit for the less-than detection limit result in the RPD formula. For RPDs between original samples and duplicate samples, the following criteria are used:

- If the detected concentrations are between the undiluted detection limit and 10 times that detection limit, the RPD should be less than 100 percent.





- If detected concentrations are between 10x and 100x the detection limit, the RPD should be less than 30 percent.
- If the detected concentrations are greater than 100x the detection limit, the RPD should be less than 50 percent.

If field duplicate analysis for an analyte exceeds the acceptable RPD for the analyte, the concentrations of the analyte detected in the original and associated duplicate samples are subject to further review based on additional data for the Site, as described below (Section 6.1.8). Based on the outcome of this review, the data qualifiers "J" or "R" may be assigned to the original and/or the duplicate analytical result for the analyte. The results of the duplicate sample review, including rationale for assigning data qualifiers, along with the list of data qualified will be included in the summary memorandum.

#### 6.1.7 Split Samples

The analytical results for split samples will be tabulated and RPDs for each analyte will be computed. Instances in which an analyte was not detected in both samples will be identified. Instances in which an analyte was detected in only one sample and not in its split sample will also be identified, and an approximate RPD calculated by substituting the analytical detection limit for the less-than detection limit result in the RPD formula. For RPDs between original samples and split samples, the following criteria are used:

- If the detected concentrations are between the undiluted detection limit and 10 times that detection limit, the RPD should be less than 100 percent.
- If the detected concentrations are between 10x and 100x the detection limit, the RPD should be less than 30 percent.



- If the detected concentrations are greater than 100x the detection limit, the RPD should be less than 50 percent.

If split sample analysis for an analyte exceeds the acceptable RPD for the analyte, the concentrations of the analyte detected in the original and associated split samples will be subject to further review based on additional data for the Site, as described below (Section 6.1.8). Based on the outcome of this review, the data qualifiers "J" or "R" may be assigned to the original and/or the split analytical result for the analyte. The results of the split sample review, including rationale for assigning data qualifiers and the list of data qualified, will be included in the summary memorandum.

#### 6.1.8 Data Trending

Groundwater quality data for a particular sampling event will be compared to previous chemical quality data collected at that same location to accomplish the following: 1) screen field duplicate and split results that have RPDs greater than the historical data or acceptance criteria to identify data that may have to be qualified; and 2) identify any analytical results that may require qualification for which no field and/or laboratory QC problem was identified during the assessment process. This additional review is necessary to alert the user to data that are not representative of the Site. Review of previous analytical results for samples collected from a particular site may include one or all of the following:

- Review of long-term and/or short-term chemical quality hydrographs for all analytes analyzed at the sampling location.
- Review of chemical quality hydrographs for other sampling locations in the same and adjacent hydrogeologic units in the immediate vicinity of the sampling location evaluated.
- Review of maps showing areal distribution of the concentrations of the analyte in the same hydrogeologic unit.



- Review of water level hydrographs, water level contour maps, and pumpage records from nearby production wells.
- Review of historic surface water records and investigation of sources of potential recharge to groundwater systems in the vicinity of the sampling location.

Individuals familiar with the hydrogeological conditions at the Site will evaluate this information and identify a list of data that may require qualification. This list will be reviewed by the Project Manager prior to assignment of data qualifiers. Laboratory personnel may be contacted during the review process to ensure that the data subject to review were correctly reported. Field duplicate and split sample results identified as having unacceptable RPDs and determined to be out of trend will be qualified with a "J" or "R". Analytical results with no associated QC problem will be assigned the data qualifier "J" if the concentration of the sample subject to review is less than one order of magnitude higher or lower than the expected concentration of the analyte at the sampling location and is clearly outside the historic water quality trends at the Site. Analytical results with no associated QC problem will be assigned the data qualifier "R" if the concentration of the sample subject to review is greater than or equal to one order of magnitude higher or lower than the expected concentration at the sampling location; is clearly outside of the historic water quality trends at the Site; exhibits a concentration for an analyte not previously detected at the Site; or does not indicate an analyte that is routinely detected at the Site. The results of the review of data based on trend analysis will be documented in the summary memorandum.

## 6.2 CORRECTIVE ACTION

Corrective actions may be required at any point in the data assessment process. Problems with laboratory or field QC data or analytical results should be relayed as soon as possible by H+A to the Laboratory Manager. The laboratory will be instructed to check raw data and computations, as necessary, to identify any problems due to data transposition, reported units of measurement, or calculation errors. The laboratory may be instructed to re-run a partial sample if sample holding time limits have not been exceeded. The laboratory will issue an amended



hard-copy analytical report if any previously reported data are found to be in error. If major QC problems are identified during data assessment procedures, the Project Manager may request that additional samples be collected from a sample location for laboratory analysis.

### 6.3 REPORTING

The Project Manager will review the list of all data to be qualified and approve data qualifiers. Analytical results found to be satisfactory based on the data assessment process will not be qualified. Data qualifiers, will appear in tables summarizing the results of water quality analyses.

EPA data qualifiers, with the exception of "U", will appear in tables summarizing the results of water quality analyses (Table B-11). H+A uses a "less than sign" or "negative value" (< or -), to indicate that an analyte was not detected and, therefore, use of EPA's "U" qualifier is not required.

Data with EPA "J" qualifiers may be used for general site characterization purposes. These data will not be used for Site decision-making purposes, such as determining the presence or absence of contaminants, determining the effectiveness of remedial actions, assessing the cleanup status of an aquifer, or assessing the attainment of cleanup goals in an aquifer. Data with EPA "R" qualifiers will not be used for either site characterization or site decision-making purposes.



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TABLE B-1

## HANDLING PROTOCOL FOR GROUNDWATER SAMPLES

ANALYTE	EPA METHOD	SAMPLE CONTAINER	OTHER REQUIREMENTS	PRESERVATION METHOD	MAXIMUM HOLDING TIME
<u>VOLATILE ORGANIC COMPOUNDS</u>	8260B	2 X 40 ml VOA VIAL, TEFLON LINED SEPTUM	VIALS FILLED COMPLETELY, NO HEAD SPACE	HCl, COOL TO 4°C	14 DAYS
<u>DDT, BHC, and Other Organochlorine Pesticides</u>	8081A	1 X 1 LITER AMBER GLASS BOTTLE	BOTTLE FILLED TO NECK	UNPRESERVED, COOL TO 4°C	7 DAYS TO EXTRACT 40 DAYS TO ANALYZE
<u>PARACHLOROBENZENE SULFONIC ACID (pCBSA)</u>	Modified 314.0	1 X 500 ML PLASTIC	BOTTLE FILLED TO NECK	UNPRESERVED, COOL TO 4°C	28 DAYS
<u>GENERAL MINERALS</u>		1 X 1 LITER PLASTIC	BOTTLE FILLED TO NECK	UNPRESERVED, COOL TO 4°C	
Aluminum	6010B				6 MONTHS
Alkalinity	SM 2320B				14 DAYS
Calcium	6010B				6 MONTHS
Chloride	300.0				28 DAYS
Potassium	6010B				6 MONTHS
Iron	6020B				6 MONTHS
Magnesium	6010B				6 MONTHS
Manganese	6010B				6 MONTHS
Nitrate	300.0				48 HOURS
Sodium	6010B				6 MONTHS
Sulfate	300.0				28 DAYS
Specific Conductance	120.1				28 DAYS
Total Dissolved Solids	160.1				7 DAYS
Hardness	SM 2340B	1 X 500 ML PLASTIC	BOTTLE FILLED TO NECK	HNO <sub>3</sub> TO Ph <2, COOL TO 4°C	6 MONTHS
<u>CALIFORNIA TITLE 22 METALS (CCR 17 METALS)*</u>		1 X 1 LITER PLASTIC	BOTTLE FILLED TO NECK	FILTER, HNO <sub>3</sub> TO Ph <2, COOL TO 4°C	6 MONTHS
Antimony	6020B				
Arsenic	6020B				
Barium	6020B				
Beryllium	6020B				
Cadmium	6020B				
Chromium	6020B				
Cobalt	6020B				
Copper	6020B				
Lead	6020B				
Molybdenum	6020B				
Mercury	7470A				
Nickel	6020B				
Selenium	6020B				
Silver	6020B				
Thallium	6020B				
Vanadium	6020B				
Zinc	6020B				

*If not filtered in field, do not place in acidified sample bottle and instruct lab to filter and acidify upon receipt.*

28 DAYS

TABLE B-1

HANDLING PROTOCOL FOR GROUNDWATER SAMPLES


FOOTNOTES

( $\leq$ ) = Less than  
DDT = Dichlorodiphenyltrichloroethane  
BHC = Hexachlorocyclohexane

$^{\circ}\text{C}$  = degrees Celsius  
EPA = U.S. Environmental Protection Agency  
HCl = Hydrochloric Acid

lab = Laboratory  
ML = Milliliter  
VOA = Volatile Organic Analysis

NA = Not Applicable  
 $\text{HNO}_3$  = Nitric Acid

	
<b>HARGIS + ASSOCIATES, INC.</b>	
Mission City Corporate Center 2365 Northside Drive, Suite C-100 San Diego, CA 92108 Phone: 619.521.0165	
Client	Date
H+A Project No.	Sample ID
Initials	Time
Analyze for:	
Preservative/Special Instructions:	

**TABLE B-2. SAMPLE IDENTIFICATION LABEL**



**HARGIS + ASSOCIATES, INC.**DATE \_\_\_\_\_ PAGE \_\_\_\_\_ OF \_\_\_\_\_

**ORIGINAL: LABORATORY      YELLOW: QA MANAGER      PINK: FIELD/TASK MANAGER**

**TABLE B-4**
**ANALYTICAL METHOD INFORMATION FOR VOLATILE ORGANIC COMPOUNDS**

ANALYTE	REPORTING		ISGS (ug/l)	MATRIX SPIKE % R	SPIKE RPD	BLANK SPIKE/LCS	
	MDL (ug/l)	LIMIT (ug/l)				% R	RPD
Acetone	4.5	5.0	610	10-200	50	30-145	50
Benzene	0.28	2.0	1	60-125	20	70-120	20
Bromobenzene	0.27	5.0	--	None	20	80-120	20
Bromochloromethane	0.32	5.0	--	None	20	65-135	20
Bromodichloromethane	0.30	2.0	--	70-140	20	70-140	20
Bromoform	0.25	5.0	100	50-140	25	55-135	30
Bromomethane	0.20	5.0	8.7	None	30	65-140	30
2-Butanone (MEK)	3.8	5.0	1,900	15-180	50	45-155	50
n-Butylbenzene	0.37	5.0	--	None	20	75-130	20
sec-Butylbenzene	0.25	5.0	--	None	20	75-125	20
tert-Butylbenzene	0.22	5.0	--	None	20	75-125	20
Carbon disulfide	0.33	1.0	1,000	None	None	None	None
Carbon tetrachloride	0.28	0.5	0.5	None	20	65-155	20
Chlorobenzene	0.36	2.0	70	75-125	20	80-125	20
Chloroethane	0.33	5.0	8,600	None	20	60-145	20
Chloroform	0.33	2.0	100	70-130	20	70-130	20
Chloromethane	0.14	1.5	1.5	None	30	40-145	20
2-Chlorotoluene	0.28	5.0	--	None	20	75-125	20
4-Chlorotoluene	0.29	5.0	--	None	20	75-125	20
Dibromochloromethane	0.28	2.0	100	65-145	20	65-145	20
1,2-Dibromo-3-chloropropane	2.8	5.0	--	None	40	50-130	30
1,2-Dibromoethane (EDB)	0.32	2.0	--	None	20	75-125	20
Dibromomethane	0.36	2.0	--	None	20	70-130	20
1,2-Dichlorobenzene	0.32	2.0	600	None	20	80-120	20
1,3-Dichlorobenzene	0.35	2.0	17	None	25	75-120	20
1,4-Dichlorobenzene	0.37	2.0	5	70-120	20	75-120	20
Dichlorodifluoromethane	1.1	5.0	--	None	30	10-160	20
1,1-Dichloroethane	0.27	2.0	5	65-135	20	70-135	20
1,2-Dichloroethane	0.28	0.5	0.5	60-150	20	60-150	20
1,1-Dichloroethylene	0.32	5.0	--	60-135	20	70-130	20
cis-1,2-Dichloroethylene	0.32	2.0	--	None	20	70-125	20
trans-1,2-Dichloroethylene	0.27	2.0	--	None	20	70-130	20
1,2-Dichloropropane	0.35	2.0	5	None	20	65-120	20
1,3-Dichloropropane	0.30	2.0	--	None	20	70-130	20
2,2-Dichloropropane	0.29	2.0	--	None	20	70-150	20
1,1-Dichloropropylene	0.28	2.0	--	None	20	75-130	20
cis-1,3-Dichloropropylene	0.22	2.0	--	None	25	75-130	20
trans-1,3-Dichloropropylene	0.24	2.0	--	None	20	70-135	20
Ethylbenzene	0.25	2.0	700	65-125	20	70-125	20
Hexachlorobutadiene	0.42	5.0	--	None	20	70-140	20
2-Hexanone	2.5	5.0	1,604	35-165	50	40-145	50
Isopropylbenzene	0.25	2.0	61	None	20	70-125	20

TABLE B-4

ANALYTICAL METHOD INFORMATION FOR VOLATILE ORGANIC COMPOUNDS

ANALYTE	REPORTING		ISGS (ug/l)	MATRIX SPIKE		BLANK SPIKE/LCS	
	MDL (ug/l)	LIMIT (ug/l)		% R	RPD	% R	RPD
p-Isopropyltoluene	0.28	2.0	--	None	20	75-125	20
4-Methyl-2-pentanone (MIBK)	2.5	5.0	160	35-175	45	45-135	45
Methylene chloride	0.33	5.0	5	None	25	60-135	20
Naphthalene	0.33	5.0	6.2	50-145	30	50-145	30
n-Propylbenzene	0.27	2.0	61	None	20	75-130	20
Styrene	0.16	2.0	100	None	30	80-135	30
1,1,1,2-Tetrachloroethane	0.27	5.0	--	None	20	70-145	20
1,1,2,2-Tetrachloroethane	0.29	1.0	1	None	30	60-135	30
Tetrachloroethylene	0.32	2.0	5	70-130	20	80-125	20
Toluene	0.49	2.0	150	65-125	20	70-120	20
1,2,3-Trichlorobenzene	0.45	5.0	--	None	20	65-135	20
1,2,4-Trichlorobenzene	0.51	5.0	70	None	20	70-140	20
1,1,1-Trichloroethane	0.30	2.0	200	None	20	70-140	20
1,1,2-Trichloroethane	0.30	2.0	5	None	20	70-125	20
Trichloroethylene	0.26	2.0	--	70-125	20	75-120	20
Trichlorofluoromethane	0.34	5.0	--	None	25	65-145	20
1,2,3-Trichloropropane	0.34	10	--	None	25	60-130	25
1,2,4-Trimethylbenzene	0.31	2.0	12	None	20	80-125	20
1,3,5-Trimethylbenzene	0.26	2.0	--	None	25	80-125	35
Vinyl acetate	0.35	2.0	410	None	None	None	None
Vinyl chloride	0.19	0.5	0.5	40-135	20	50-130	20
o-Xylene	0.24	2.0	1,750	65-125	20	70-125	25
m,p-Xylenes	0.38	2.0	1,750	65-120	20	70-120	20

FOOTNOTES

- MDL = Method Detection Limit
- ISGS = In Situ Groundwater Standards
- ug/l = Micrograms per liter
- % R = Percent Recovery
- RPD = Relative Percent Difference
- LCS = Laboratory Control Spike
- (--) = Not available

TABLE B-5

ANALYTICAL METHOD INFORMATION FOR ORGANOCHLORINE PESTICIDES

ANALYTE	MDL	REPORTIN		MATRIX SPIKE		BLANK SPIKE/LCS	
		G LIMIT (ug/l)	ISGS (ug/l)	% R	RPD	% R	RPD
Aldrin	0.0026	0.004	0.004	35-115	20	45-115	20
alpha-BHC	0.00049	0.005	0.011	30-110	25	50-115	20
beta-BHC	0.0023	0.01	0.037	30-115	25	65-115	20
delta-BHC	0.015	0.20	--	40-135	30	70-115	20
gamma-BHC (Lindane)	0.015	0.10	0.2	35-125	20	55-115	20
Chlordane	0.057	1.0	--	None	None	None	None
2,4'-DDD*	0.0076	0.10	0.28	55-120	20	70-120	20
2,4'-DDE*	0.012	0.10	0.20	55-115	20	65-115	20
2,4'-DDT*	0.0092	0.10	0.20	60-120	20	70-120	20
4,4'-DDD	0.013	0.10	0.28	55-120	20	70-120	20
4,4'-DDE	0.013	0.10	0.20	55-115	20	65-115	20
4,4'-DDT	0.019	0.10	0.20	60-120	20	70-120	20
Dieldrin	0.012	0.10	--	50-115	20	60-115	20
Endosulfan I	0.011	0.10	--	45-115	20	60-115	20
Endosulfan II	0.037	0.10	--	55-120	20	55-115	20
Endosulfan sulfate	0.025	0.20	--	50-150	25	65-120	20
Endrin	0.011	0.10	2	60-115	20	65-115	20
Endrin aldehyde	0.016	0.10	--	50-125	20	65-115	20
Endrin ketone	0.012	0.10	--	55-145	20	65-115	20
Heptachlor	0.0025	0.01	0.01	35-125	20	55-120	20
Heptachlor epoxide	0.0033	0.005	0.01	35-115	20	60-115	20
Methoxychlor	0.031	0.10	--	35-135	25	70-115	20
Toxaphene	1.3	5.0	--	None	None	None	None

FOOTNOTES

- (\*) = Result for this compound is qualitative due to coelution difficulties
- MDL = Method Detection Limit
- ISGS = In Situ Groundwater Standards
- ug/l = Micrograms per liter
- % R = Percent Recovery
- RPD = Relative Percent Difference
- TBD = To be determined based on future MDL study
- LCS = Laboratory Control Spike
- BHC = Hexachlorocyclohexane
- DDD = Dichlorodiphenyldichloroethane
- DDE = Dichlorodiphenyldichloroethylene
- DDT = Dichlorodiphenyltrichloroethane
- (--) = Not available

TABLE B-6

ANALYTICAL METHOD INFORMATION FOR pCBSA

ANALYTE	MDL (ug/l)	REPORTING LIMIT (ug/l)	MATRIX SPIKE		BLANK SPIKE/LCS	
			% R	RPD	% R	RPD
pCBSA	5	10	75-125	15	85-115	20

FOOTNOTES

MDL = Method Detection Limit  
ug/l = Micrograms per liter  
% R = Percent Recovery  
RPD = Relative Percent Difference  
LCS = Laboratory Control Spike  
pCBSA = parachlorobenzene Sulfonic Acid

**TABLE B-7**

**ANALYTICAL METHOD INFORMATION FOR GENERAL MINERALS**

ANALYTE	MDL (mg/l)	REPORTING		MATRIX SPIKE % R	RPD	BLANK SPIKE/LCS % R	RPD
		LIMIT (mg/l)					
Aluminum	0.047	0.050		75-125	20	80-120	20
Alkalinity <sup>(a)</sup>	2.0	2.0		None	None	None	None
Calcium	0.015	0.10		70-130	20	85-115	20
Chloride	0.26	0.50		80-120	20	90-110	20
Potassium	0.066	0.50		70-130	20	85-115	20
Iron	0.0088	0.040		70-130	20	85-115	20
Magnesium	0.0030	0.020		70-130	20	85-115	20
Manganese	0.0032	0.020		70-130	20	85-115	20
Sodium	0.095	0.50		70-130	20	85-115	20
Sulfate	0.25	0.50		80-120	20	90-110	20
Total Dissolved Solids	10	10		None	None	90-110	20
Nitrate	0.072	0.11		80-120	20	90-110	20

**FOOTNOTES**

(a) The only QC performed is a duplicate analysis.

MDL = Method Detection Limit  
mg/l = Milligrams per liter  
% R = Percent Recovery  
RPD = Relative Percent Difference  
LCS = Laboratory Control Spike  
QC = Quality Control

TABLE B-8

ANALYTICAL METHOD INFORMATION FOR CALIFORNIA TITLE 22 METALS

ANALYTE	REPORTING					
	MDL (ug/l)	LIMIT (ug/l)	MATRIX SPIKE % R	SPIKE RPD	BLANK SPIKE/LCS % R	LCS RPD
Antimony	0.54	2.0	75-125	20	80-120	20
Arsenic	0.70	1.0	75-125	20	80-120	20
Barium	0.053	1.0	75-125	20	80-120	20
Beryllium	0.078	0.50	75-125	20	80-120	20
Cadmium	0.13	1.0	75-125	20	80-120	20
Chromium	0.35	1.0	75-125	20	80-120	20
Cobalt	0.11	1.0	75-125	20	80-120	20
Copper	0.24	2.0	75-125	20	80-120	20
Lead	0.070	1.0	75-125	20	80-120	20
Molybdenum	0.14	1.0	75-125	20	80-120	20
Mercury	0.063	0.20	75-120	20	90-115	20
Nickel	0.20	1.0	75-125	20	80-120	20
Selenium	0.28	2.0	75-125	20	80-120	20
Silver	0.13	1.0	75-125	20	80-120	20
Thallium	0.083	1.0	75-125	20	80-120	20
Vanadium	0.70	1.0	75-125	20	80-120	20
Zinc	0.97	20	75-125	20	80-120	20

FOOTNOTES

MDL = Method Detection Limit  
 ug/l = Micrograms per liter  
 % R = Percent Recovery  
 RPD = Relative Percent Difference  
 LCS = Laboratory Control Spike

TABLE B-9

FIELD PROCEDURES AND QUALITY ASSURANCE OBJECTIVES

PROCEDURE	EQUIPMENT CHECK AND/OR CALIBRATION	OPERATIONAL PROCEDURE	PERSONNEL	DATA STORAGE SYSTEM	PRECISION	ACCURACY
Water Level Measurement	Electric water level sounder, steel tape, interface probe	SOP and manufacturer instructions for equipment	Hydrogeologist, field technician	Hard copy, electronic	0.01 foot	±0.1 foot
Water Sample Collection (excludes determination of electrical conductivity, pH, and temperature)	Depth specific sampling devices, sample bottles, shipping containers, transmittal forms, chain-of-custody records, field forms	SOP	Hydrogeologist, field technician	Hard copy	NA	NA
Electrical Conductivity	Conductivity meter, field form	SOP and manufacturer instructions for equipment	Hydrogeologist, field technician	Hard copy	±5 umhos when scale units are x1	±10 umhos when scale units are x1
Turbidity	Turbidity meter, field form	SOP and manufacturer instructions for equipment	Hydrogeologist, field technician	Hard copy	Based on instrument	Based on instrument
Dissolved Oxygen	Photometric meter, appropriate filters, high and low range ampoules, field form	SOP and manufacturer instructions for equipment	Hydrogeologist, field technician	Hard copy	Based on instrument	Based on instrument
pH	pH meter, field form	SOP and manufacturer instructions for equipment	Hydrogeologist, field technician	Hard copy	±0.05 unit	0.5 unit
Temperature	Field thermometer, field form	SOP and manufacturer instructions for equipment	Hydrogeologist, field technician	Hard copy	±0.1°C	±0.5°C

FOOTNOTES

SOP = Standard Operational Procedure  
NA = Not Applicable

umhos = Micromhos  
°C = Degrees Celsius



**TABLE B-10**

Category: \_\_\_\_\_  
Method: \_\_\_\_\_  
Parameters: \_\_\_\_\_

**SAMPLE ID#**

**TABLE B-10  
ANALYTICAL DATA ASSESSMENT CHECKLIST**

QUESTION	YES	NO	NA	ASSESSMENT FINDINGS	ASSIGNED QUALIFIER	ASSOCIATED DATA
<b>I. Documentation Verification &amp; Holding Times</b>						
A. Was the sampling date, sample ID, sample description, and project number on the chain of custody (COC) record verified with those on the laboratory analytical report?	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____
B. Were the analytical methods specified on the COC record and lab work order verified with those on the laboratory analytical report?	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____
C. Were the correct sample preservation methods used? Note preservation.	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____
D. Were the holding times met for all samples?	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____
E. Are the "totals" listed for isomers and metabolites, such as BHC and DDT, correctly added?	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____



TABLE B-10  
ANALYTICAL DATA ASSESSMENT CHECKLIST

QUESTION	YES	NO	NA	ASSESSMENT FINDINGS	ASSIGNED QUALIFIER	ASSOCIATED DATA
II. Blanks, Spikes, and Surrogates						
A. 1. Were any analytes detected in the trip blanks? Note the presence of these analytes in the trip blank and their concentrations.	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____
2. Were any of the analytes present in the trip blanks detected in any of the samples? Note these analytes and concentrations.	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____
B. 1. Were any analytes detected in the field blanks? Note the presence of these analytes in the field blank and their concentrations.	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____
2. Were any of the analytes present in the field blanks detected in any of the samples? Note these analytes and concentrations.	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____
C. 1. Were any analytes detected in the reagent or method blanks? Note the presence of these analytes in the reagent or method blanks and their concentrations.	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____
2. Were any of the analytes present in the reagent or method blanks detected in any of the samples? Note these analytes and concentrations.	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____
D. Are check standards or laboratory control standards (LCS) within the laboratory acceptance criteria?	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____

**TABLE B-10**  
**ANALYTICAL DATA ASSESSMENT CHECKLIST**

QUESTION	YES	NO	NA	ASSESSMENT FINDINGS	ASSIGNED QUALIFIER	ASSOCIATED DATA
E. Are the spike recovery results within the laboratory acceptance criteria?	—	—	—	_____	_____	_____
Equation:				_____	_____	_____
% Recovery =				_____	_____	_____
(Spike sample result - Sample result) x 100 Spike concentration				_____	_____	_____
F. Are relative percent differences (RPDs) between the spike and spike duplicate within the laboratory acceptance criteria?	—	—	—	_____	_____	_____
Equation:				_____	_____	_____
RPD =				_____	_____	_____
(Spiked sample result - Duplicate spike result) x 100 Average result				_____	_____	_____
G. Are the surrogate recovery results within the laboratory acceptance criteria?	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____
III. Field Duplicates & Splits						
A. Are the RPDs for original samples versus field duplicates within the Hargis + Associates, Inc. (H+A) acceptance criteria?	—	—	—	_____	_____	_____
Equation:				_____	_____	_____
RPD =				_____	_____	_____
(Original sample result - Field duplicate result) x 100 Average result				_____	_____	_____
B. Are the RPDs for original sample versus split lab samples within the H+A acceptance criteria?	—	—	—	_____	_____	_____
Equation:				_____	_____	_____
RPD =				_____	_____	_____
(Original sample result - Split sample result) x 100 Average result				_____	_____	_____

TABLE B-10  
ANALYTICAL DATA ASSESSMENT CHECKLIST

QUESTION	YES	NO	NA	ASSESSMENT FINDINGS	ASSIGNED QUALIFIER	ASSOCIATED DATA
IV. Reportable Detection Limits						
A. Are the reportable detection limits (RDLs) the same as laboratory established RDLs?	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____
B. Are any analytes reported at less than the RDL?	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____
C. Are the RDLs consistent with the dilution factor reported?	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____
V. Trending						
A. Are data comparable to past concentration trends? Note and evaluate any apparent anomalies. Use order of magnitude as a guideline.	—	—	—	_____	_____	_____
				_____	_____	_____
				_____	_____	_____
				_____	_____	_____

QC = Quality control  
ID = Identifier  
NA = Not applicable  
COC = Chain of custody  
BHC = Hexachlorocyclohexane  
DDT = Dichlorodiphenyltrichloroethane  
LCS = Laboratory control standards  
RPDs = Relative percent differences  
H+A = Hargis + Associates, Inc.  
RDLs = Reportable detection limits

**TABLE B-11**

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
DATA QUALIFIERS**

- J The associated numerical value is an estimated quantity because quality control criteria were not met.
- R Quality control indicates that data are unusable (compound may or may not be present). Resampling and/or reanalysis is necessary for verification.
- Q No analytical result.
- N Presumptive evidence of presence of material (tentative identification).